REFERENCE FILE

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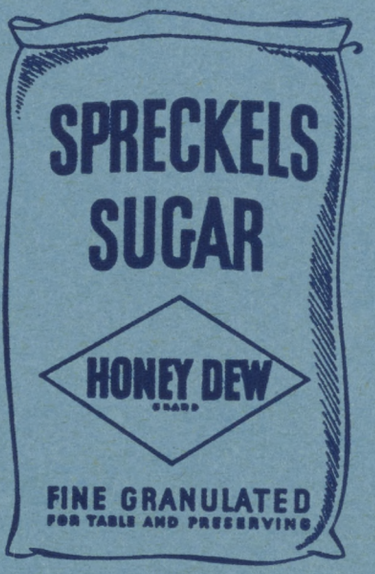
VOLUME X 1946



ISSUED BY SPRECKELS SUGAR COMPANY . . . ESTABLISHED 1897

EXECUTIVE OFFICE — SPRECKELS SUGAR COMPANY

Two Pine Street

San Francisco 11, California

Authorized Capital Stock	$12,500,000.00
Capital Stock Outstanding	9,000,000.00

Frank J. Belcher, Jr.	President and Director
Alexander de Bretteville	First Vice-President and Director
W. H. Hannam	Second Vice-President and Director
J. N. Rosekrans	Director
H. W. Clark	Director
Carl Huttlinger	Director
H. Beach Carpenter	Director
A. B. Wollam	Director
C. J. Moroney	Vice-President and General Manager
M. R. Obitz	Sales Manager
R. L. Regal	Secretary and Treasurer
J. K. Scott	Assistant Secretary and Assistant Treasurer
C. A. Thulander	Comptroller
J. E. Coke	General Agriculturist
W. J. Resch	General Superintendent
P. W. Alston	General Chemist
W. K. Gray	Chief Engineer

TWO PINE STREET — SAN FRANCISCO

Factories	*Erected*	*Daily Capacity (Tons of Beets)*	*Superintendent*
Spreckels, California	1899	5,300	Ira A. Resch
Manteca, California	1917	1,875	A. A. Norman
Woodland, California	1937	2,350	W. W. Conner
		9,525	

SPRECKELS SUGAR BEET BULLETIN

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. X JANUARY-FEBRUARY 1946 No. 1

1

A typical view of the two-row Marbeet harvester in operation. The loaded truck can be replaced by the empty one without loss of harvester time as the loading of beets can be stopped by disengaging the beet elevator clutch without stopping the harvester. The efficiency of operation of these machines depends to a large degree upon the attention paid to management detail such as the one illustrated in the above picture.

MECHANICAL HARVEST INCREASES GROWER PROFITS

*COST PER TON—HAND HARVEST	$2.13
*COST PER TON—MACHINE HARVEST	1.28
NET GAIN TO GROWER	**$ .85**

COST OF HAND HARVEST

Plowing out per acre	$ 3.00
Topping and loading—15 tons at 20 per cent over Government scale	27.00
Contractor's bonus per acre	1.00
Camp charge or expense	1.00
Cost per acre	$32.00

(Or—**$2.13** per ton)

COST OF MECHANICAL HARVEST

Tractor, 10 hours per day	$ 30.00
Labor, 2 men, 10 hours	25.00
Rental, $10.00 per acre	60.00
Cost per day	$115.00

(6 acres at 15 tons, or 90 tons—cost per ton—**$1.28**)

*All cost figures based on a 15 ton crop and averages of costs to growers in both Salinas and Sacramento Valley districts.

OUTSTANDING PERFORMANCES OF MARBEET HARVESTERS 1945 SEASON

Largest acreage covered by one harvester for the season	508.2 (acres)
Largest tonnage delivered from one machine for the season	8,570 (tons)
Most acreage covered in one week	47 (acres)
Most tons delivered in one week	1,220 (tons)
Largest tonnage delivered in one day	306 (tons)

(Machines rented by Spreckels Sugar Co. to growers)

HONEY-DEW

MARBEET HARVESTER PERFORMANCE IN THE SACRAMENTO AND SAN JOAQUIN VALLEYS

By AUSTIN ARMER, *Agricultural Engineer*
Spreckels Sugar Company

The Spreckels Sugar Company made available to its growers in the central valleys twenty-two Marbeet harvesters during the 1945 harvest season. These twenty-two machines and four grower-owned machines harvested more than 5,000 acres of beets. Growers using these harvesters effected a substantial saving of money and labor, in addition to greatly shortening the harvesting period.

GENERAL PERFORMANCE

The seasonal performance of the harvesters varied widely. The two-row machines harvested for the season an average close to 300 acres. The greatest acreage harvested by one machine was 450, compared with the lowest acreage of 130. Neither of these two machines lost over 7 per cent of operating time due to mechanical troubles, and operating conditions (weeds, soil, etc.) were more severe for the machine covering the most acreage. Each machine was operated by a single grower, so no appreciable time was lost in transportation between fields. Both growers operated under the same quotas, and were subject to the same weather conditions.

Why, then, this wide variation? Here are some of the reasons for the slow harvest:

1. Inadequate tractor size.
2. Insufficient trucks.
3. Low daily hours of operation.
4. Interrupted operation of harvester.

The importance of adequate tractor size is demonstrated in the following tabulation, which shows actual average weekly acreage harvested by two-row machines drawn by various types of tractors.

Drawbar Horsepower	Average Weekly Acreage
45-50	20-27
55-60	33-35
70-85	35-40

The figures clearly demonstrate the influence of power on the output of Marbeet harvesters compared under a wide variety of field conditions.

SPECIAL PROBLEMS

Of the 5,000 or more acres harvested, the majority of fields presented no special problems for machine operation. Difficulties were encountered by machine operators in some fields, which slowed down and, in a few cases, stopped mechanical harvesting completely.

These difficulties in order of importance were:

1. Excessively muddy conditions.
2. Heavy weed growth, particularly water grass.
3. Abnormally large top growth.
4. Extremely high-crowned beets.
5. Dry, sandy soils.
6. Dry, adobe type soils.
7. Extremely small beets in dry soils.

The first three items caused trouble principally by clogging the harvester's topping mechanism, and by requiring such frequent stops for clean-out that continuous operation was impractical. Clogging of coulters by water grass was very troublesome, and was helped by removing the forward plows, provided the soil was soft and the beets were low-crowned.

Excessive weed or top growth has been successfully overcome in some cases by mowing, swathing or "sheeping off." Mowing has the disadvantage of leaving debris in the rows. Swathing was much more satisfactory since the debris was deposited on land from which beets had already been harvested. "Sheeping off" large tops has been successful in some cases, but sheep must be kept moving or they will eat into the beet crowns, which prevents proper spiking by the harvester pickup wheels.

2

Spreckels Sugar Company service truck making repairs in the field. These trucks are equipped to make all types of repairs in the field and also carry a supply of parts. The servicing of harvesters in the field reduced the time lost from mechanical breakdown. The number of service trucks of this type will be increased for the 1946 operations.

Where water grass infestation was extreme none of the above methods made machine operation possible, since the grass roots formed a continuous sod which literally peeled the embedded beets away from the pickup wheels.

Extremely high crowned beets resulted in frequent breakage of beets, leaving most of the beet on the ground and carrying only the crown on the pickup wheels. This condition was frequently cured by attaching chisels to the forward plows.

Unusually dry soil conditions resulted in some beets being left loose in the ground, and all efforts to adjust plows or otherwise cause better pickup were without success. In some cases the number of beets left in the ground was enough to justify gleaning. A sled drawn by the harvester provided an inexpensive and effective aid for the gleaners, and made machine operation profitable under circumstances where as much as 10 per cent of the beets would have been left in the field.

3

Swathing just ahead of the harvester in a field with a heavy growth of water grass. The excessive weed growth and tops are deposited in the area already harvested. This eliminates some of the plugging in the sickle and around the plows of the harvesters.

IMPROVEMENTS IN FUTURE HARVESTERS

The 1945 Marbeet harvester was such an improvement over the 1944 model that there is no doubt as to the eventual perfecting of the machine. Whereas the average 1944

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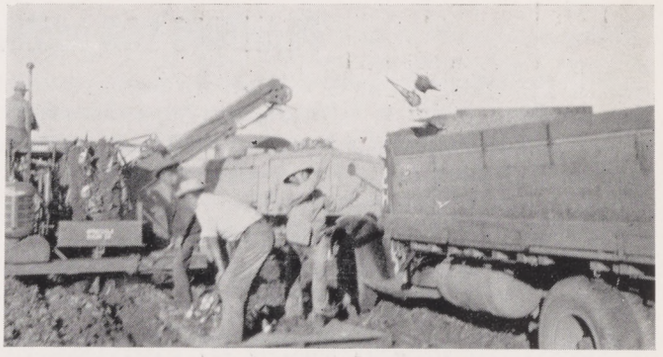
Regular belt type conveyor on Marbeet Harvester operated after a rain. The excessive dirt did not stop the harvester operation, but was a problem in hauling as some loads contained as much as 50 per cent dirt.



5

Scavenging beets with a sled behind the harvester. Loading beets into an empty truck before it pulls into position under the harvester avoids delay.

machine was out of service 40 per cent of its operating time due to mechanical breakdown, the average 1945 machine lost only 5.8 per cent of its operating time from mechanical breakdown. The excellent mechanical record of these machines was possible not only because of the improvement in mechanical design but due to the effective work of the company and grower service crews in keeping the machines in operation.

The 1946 models will embody some 28 separate items of mechanical improvement. Again in 1945, as in 1944, faults were carefully analyzed and corrections worked out jointly by the engineers of the Blackwelder Manufacturing Company and the Spreckels Sugar Company. Some of the more important improvements are:

Unbreakable steel conveyor belt pulleys.

Reinforced main frame and subframe.

Redesigned trash roller to prevent breakage.

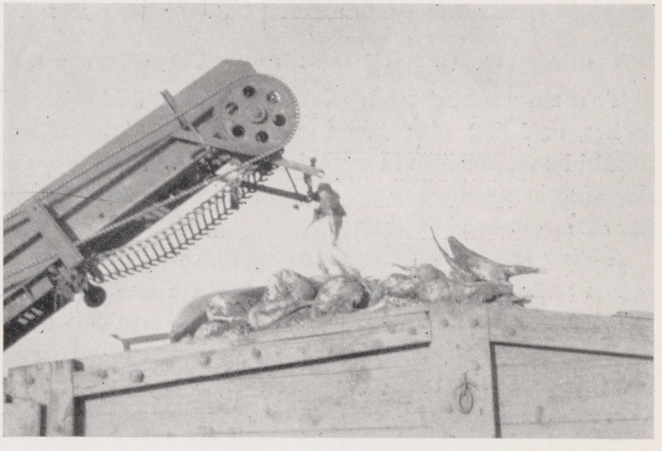
Two-piece forged steel topping knives.

Dirt-sealed foliage conveyor.

Wider range of plow adjustment.

Potato chain beet elevator for better dirt removal.

The last item has proved to be of great value. The six 1944 machines modernized in the shops of the Spreckels Sugar Company were equipped with potato chain elevators and their performance records show a marked reduction in dirt delivered with beets. The conventional rubber belt elevator delivered from 1.7 to 3.6 times as much dirt as the potato chain elevator.



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Potato chain type elevator, operating in conditions identical to those for the conveyor illustrated on the left, delivered little dirt. Under wet soil conditions, the machines equipped with potato chain were the only ones that were economical to operate.

PLANTING FOR MECHANICAL HARVEST IN 1946

With the change from hand to mechanical harvesting, growers have found it advantageous to make certain changes in their plantings to adjust the requirements of mechanical harvest to their available tractors. In the districts where bed planting is customary some growers are concerned with the excessive side drafts on their tractors and the fact that beets tend to tip out toward the furrow, making it diffcult to spike the beets firmly. Other growers want wider and deeper furrows in order to regulate their irrigation and yet fit their harvest to either a two-row or one-row machine. The following articles show what can be done to adjust plantings to meet individual requirements.

One-row harvesters will handle any evenly spaced planting from 20 inches to wider spacings of 30 or 40 inches. The two-row harvester can harvest rows spaced from 13 inches to 21 inches.

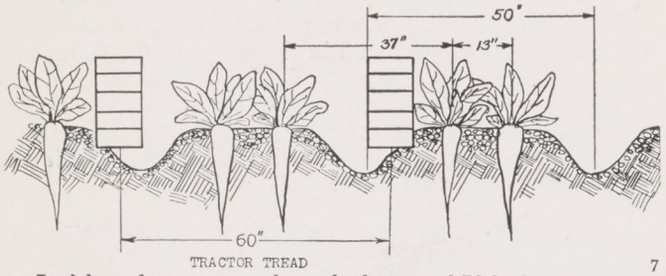
PLANTING SUGAR BEETS IN MONTEREY COUNTY ON 50-INCH BEDS

By A. A. TAVERNETTI, *County Agent*
Salinas, California

Machine harvesting sugar beets on a 40-inch bed requires a 9 to 12-inch side draft on tractor pull, resulting in two-thirds of the pull on one track and one-third on the other. Widening the beds to 50 inches will eliminate all side draft.

Changing to 50-inch beds would reduce bed length from 13,000 feet to some 10,300 feet, resulting in a saving in forward travel of the harvester of one-half mile per acre. The daily output of the harvesters would be increased. The same increase in output would be reflected in all tillage operations on beds. Wide beds will eliminate the necessity of lifting and hand-topping headlands.

The over-all width of most tractors used in harvesting is 76 inches. On 50-inch beds the distance between the two inside beet rows next to the tractor would be 87 inches. This allows a clearance of 5½ inches on each side of the tracks. If the rows on the bed are spaced more than 13 inches apart, the bed should be a little wider than 50 inches.



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Position of tractor tracks on beds spaced 50 inches apart.

To maintain beet population, spacing should be 8 to 10 inches, or 120 to 150 beets per 100 feet of row. There should be no increase in cost of thinning as the amount of fingering is not increased since the total number of beets per acre remains constant.

Adding 10 inches to the furrow width will make possible higher and wider shoulders, reducing the number of beets which grow at an angle toward the furrow and which are easily broken off in harvesting. A wider bed will make possible dropping the tops in such position as practically to escape being run over by the truck wheels.

Growers in the Salinas area prefer the two-row harvesting machine. If a single-row unit is to be used, row spacings must be wide enough to accommodate the tractor used in harvesting.

IMPROVED SINGLE ROW MARBEET JR. HARVESTER IS DEVELOPED

By AUSTIN ARMER, *Agricultural Engineer*
Spreckels Sugar Company

In order to meet the demand for a beet harvester capable of accommodating a wide range of row spacings, and requiring a minimum of tractor power, the Blackwelder Manufacturing Company has developed a radically improved single-row machine.

Two models of the new harvester have been intensively tested throughout the 1945 season, not only in California, but in other sugar beet growing states. This program of development in the field rather than on the drawing board has made possible the rapid development of a field-worthy harvester. This machine can be drawn by a small crawler tractor, or in light soils with a large wheel tractor.

The basic improvements worked out for the 1946 two-row harvester are incorporated in the 1946 "Junior" model. Thus all functional elements, such as pickup wheel, topping system and drives, are the same as used in the improved two-row machine.

Outstanding features of the Marbeet Junior are:

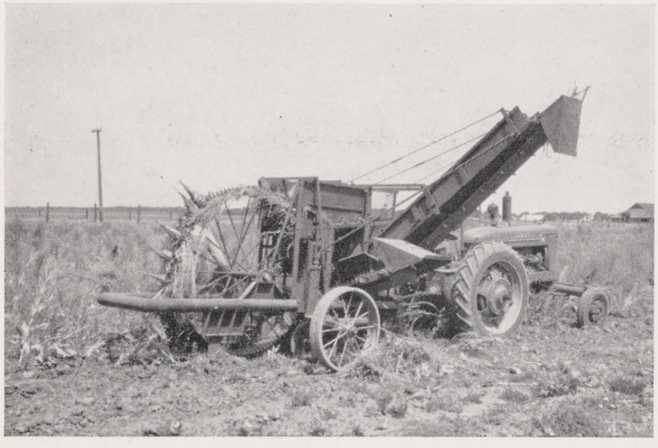
1. Unit frame construction with crank axle (eliminating the need for separate main frame and sub-frame).
2. Ground wheels adjustable for all uniform row spacings from 20″ to 40″ inclusive.
3. Implement type rubber tires and ball bearings on ground wheels.
4. Two sets of filter rolls to increase dirt elimination.
5. Dirt separator on foliage conveyor.
6. Windrowing device for tops.
7. Low-draft plow system.
8. Wheel lock to prevent back-roll of pickup wheels.

8

Marbeet Jr. harvester can be pulled with a small crawler tractor or, in light soils, with a large wheel tractor. The model shown above is driven from the tractor's power take-off, but can be driven with an auxiliary engine on the harvester.

The basic Marbeet Junior receives its auxiliary power from the tractor power take-off, and utilizes the tractor hydraulic pump as a source of oil pressure for the lift mechanism. However, all machines to be purchased by the Spreckels Sugar Company for rental to its growers will have integral hydraulic pumps. Should the grower's tractor lack a power takeoff, the Company will provide a heavy duty air cooled engine on the harvester. In this case the harvester becomes a completely self-contained unit, requiring only to be hitched to the tractor.

Because of the low draft of the Marbeet Junior, a higher down-row speed is possible than with the two-row machine. Thus, the Junior can cover from 55-65 per cent of the acreage that a two-row machine can harvest per day.



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Because of the low draft of the Marbeet Jr. harvester, its down-the-row speed is higher than the 2-row machine. This machine has a device which deflects the beets, enabling the tops to be windrowed without being run over by the trucks.

WIDER ROW PLANTINGS FOR SUGAR BEETS

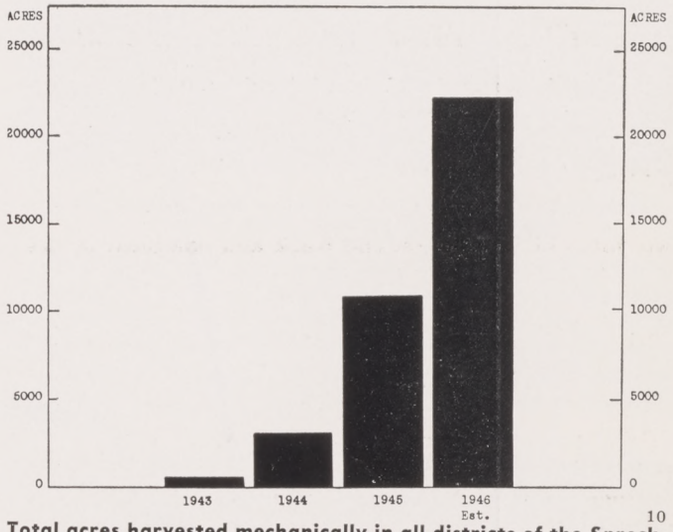
There has been a great deal of discussion and experimentation during the past year by growers and sugar companies on wider row spacings of sugar beets. The reason for much of the interest has been in the adaptability of the wider rows to mechanical harvest, and also in making easier certain cultural practices.

During the 1945 season the Spreckels Sugar Company carried on carefully planned plots in the Sacramento and Salinas districts to determine the relative yield of the various row spacings. The results are as follows:

Treatment	Gross Tons of Sugar Per Acre	Tons of Beets Per Acre	Per Cent of Sucrose	No. Beets Per 100' of Row
Sacramento Valley:				
14" x 26" ridge	3.957	25.211	15.7	111
20" flat	3.867	25.722	15.0	108
30" ridge	3.585	23.515	15.2	127
40" ridge	3.066	21.105	14.5	180
Santa Clara Valley:				
16" x 24" ridge	4.250	24.353	17.5	104
40" ridge	3.574	20.778	17.2	186
Salinas Valley:				
16" x 24" ridge	5.588	34.108	16.4	93
40" ridge	5.056	30.530	16.6	170

It should be noted in these results that an attempt was made to maintain the same population of beets per acre in all treatments so that row spacing would be the only variable. The results clearly indicate that yield of beets and sugar per acre were sacrificed in the wider spacings as compared with the normal 20-inch flat or 14 x 26 ridge planting. Because it would be difficult under field conditions to obtain stands in the wider spacings comparable with those in the trials it would be reasonable to expect that yields would be reduced even further by light stands indiscriminately spaced.

Growers who desire to plant on the wider rows because of the advantages to be gained in mechanical harvest or in their cultural operations should consider carefully the amount of seed planted and the number of beets left in the field by the thinners.



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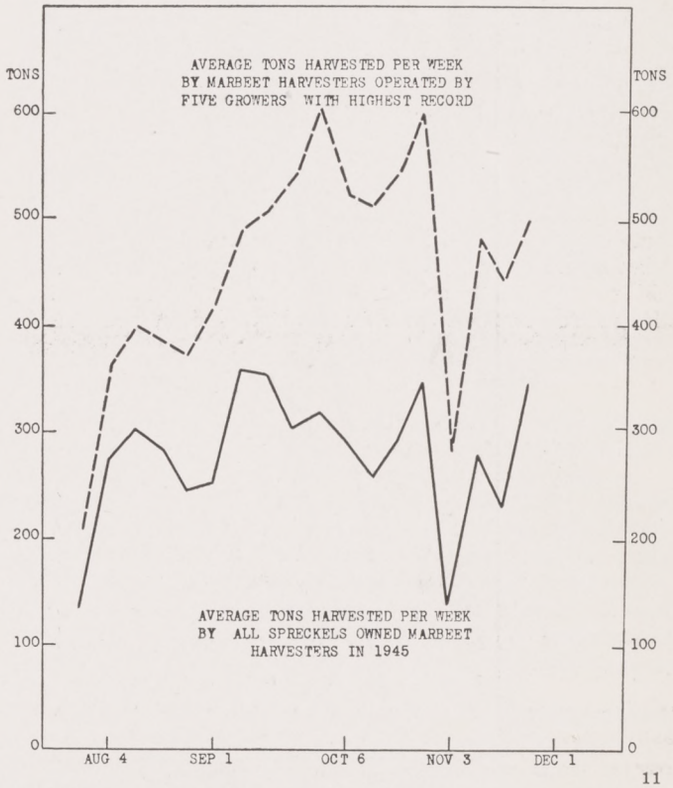
Total acres harvested mechanically in all districts of the Spreckels Sugar Company for the past three years and the estimated acreage that will be harvested mechanically in 1946.



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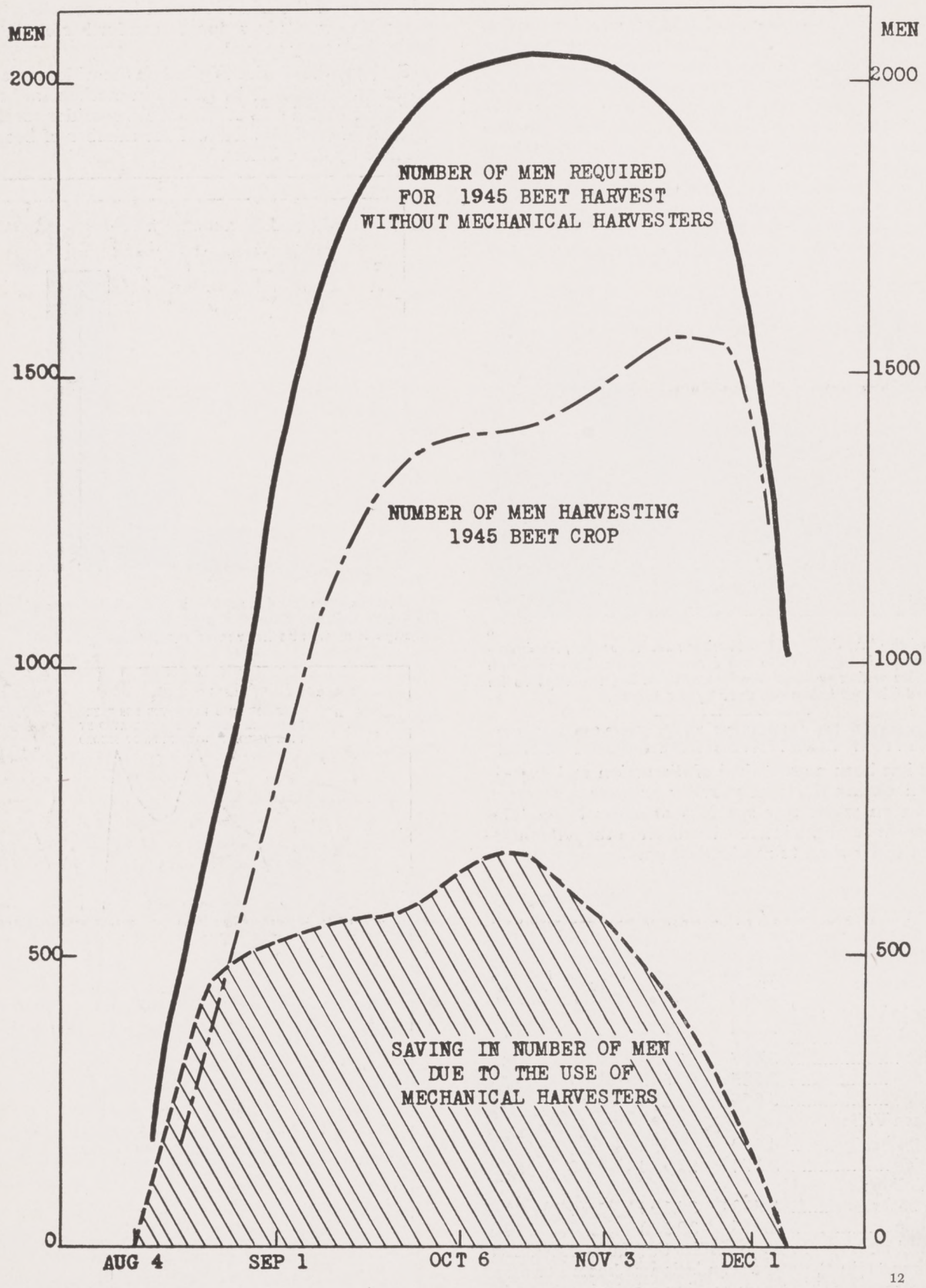
The above graph shows the wide difference in performance in tons harvested each week for all Marbeet harvesters operating in the Spreckels Sugar Co.'s districts as compared with the weekly average of the Marbeet harvesters operated by the five growers with the highest record. The higher output of these growers can be used as a goal in the 1946 harvest season as it shows what can be done by efficient operation.



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The greatest contribution of the mechanical harvester to the sugar beet industry has been the decrease in the number of laborers required to harvest the crop. The above graph shows the total labor requirements that would have been needed to supply the volume of beets actually harvested during 1945 and the number of men who were actually used. Being able to harvest to factory capacity in a year of limited labor supply was possible only because the output of the mechanical harvesters was equal to that of over 500 men.

MARBEET HARVESTER OPERATIONS IN THE SALINAS DISTRICT

By WILLIAM J. REDDING, JR., *Assistant Agricultural Engineer, Spreckels Sugar Company*

The 19 Marbeet harvesters rented by the Spreckels Sugar Company to its growers in the Salinas district harvested 6,000 acres, operating from August 13 to December 8. Delivery of beets from these machines maintained a very uniform rate up to October 27, when unseasonal rainfall began to interfere seriously with mechanical harvest. This uniform delivery rate was most helpful in stabilizing the factory operation, and much credit goes to the users of these harvesters for the quality of their field management.

The beet fields of the Salinas Valley, as well as the neighboring Watsonville, Gilroy, San Juan and Hollister districts, present harvesting problems differing greatly from those elsewhere in California. Conditions prevalent in these districts are:

High yields, with very large beets.
Heavy top growth.
Soils either very heavy or very abrasive.
Large beet trucks or semitrailers up to 20-ton capacity.
Large tractors, ranging from 55 to 85 drawbar horsepower.

13

An ensilage cutter working ahead of the harvester in exceptionally heavy tops. All the top debris was deposited on ground already harvested so there was no trash to plug the plows and sickle.

14

A windrow pickup baler at work baling beet tops after the harvest was completed.

15

Using a small trailer attached to the back of the harvester for scavenging beets.

The prevalence of exceptionally large beets resulted in occasional failure of the pickup wheels to carry the beets to the topping knives, or breakage of the crown, leaving a large part of the beet remaining on the ground surface. In such cases a gleaning operation was desirable, and was done with a sled or cart attached to the rear of the harvester.

16

One way of overcoming insufficient tractor power. Although not as economical as one large tractor, this tandem hitch allowed growers to use the harvester where otherwise they would have had to use hand labor.

Where tops were so heavy as to interfere with spiking or topping, the use of an ensilage cutter enabled the harvester to follow through with complete satisfaction.

Heavy soil conditions were met by using large tractors, and by judiciously adjusting plow depth. It was found possible to harvest even the largest beets with a surprisingly shallow plow adjustment, often less than 9 inches from rear plow tips to pickup wheel rim. The reward of such shallow plowing was decreased draft and elimination of strains on the harvester. Excessive draft frequently caused sprung sub-frames or broken main frames.

Abrasive soils are not in themselves an obstacle to good harvester operation, but require frequent plow share replacement. Here again, good management went far toward reducing rapid consumption of plow shares. By maintaining three sets of shares, one in use on the machine, a second available for replacement as soon as the first showed slight wear, and a third in the shop being hardfaced, it was possible to maintain continuous opera-

(Continued on next page)

MARBEET IN SALINAS DISTRICT *(Continued from preceding page)*

tion. The consumption of shares was accordingly far less than when they were allowed to wear beyond repair, and machine performance is always better with sharp shares.

The prevalence of large trucks presented no special problems, although drivers must be more alert in avoiding collision with the beet elevator because of obscured vision. In general, however, the large trucks were superior to smaller units. Two large trucks could amply serve one harvester, even where hauls were long. Naturally, there was some waiting time for trucks in the field, but this represented far less loss of man hours than when harvesters were idle for want of trucks.

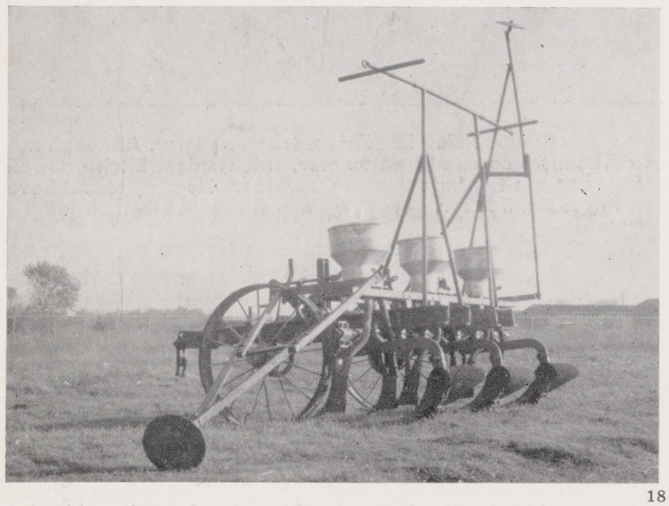
Truck operators showed a definite preference for hauling machine-harvested beets rather than hand-harvested beets. This resulted from the uniform speed in the field while loading from harvesters, while hand loading required frequent starts and stops with consequent clutch wear and axle damage.

Large tractors, especially those in the 85-horsepower range, occasionally exerted destructive force on harvester main frames. Apparently much of the main frame breakage was due to vibration rather than jolts in turning or steering. The 1946 machines will have reinforced main frames, and no further trouble of this nature is anticipated.

FERTILIZING BEFORE PLANTING SUGAR BEETS

By GUY D. MANUEL, *Agricultural Superintendent*
Spreckels Sugar Company

In the past, the most common practice in using commercial fertilizer on sugar beets has been as a side dressing after thinning. Developments in the Salinas and San Joaquin Valleys have modified this practice to a large extent. More and more commercial fertilizer is being applied before planting or at planting time with excellent results. Some growers have incorporated the two practices and put on a heavy application before planting and a lighter side dressing after thinning.



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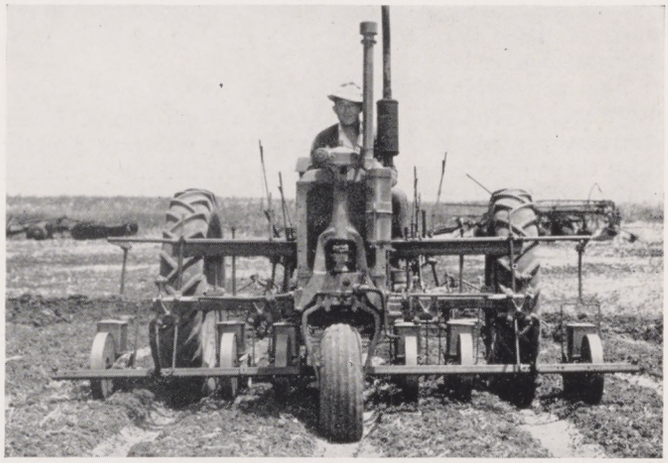
A fertilizer lister developed by the Agricultural Engineering Department of the Spreckels Sugar Company. The machine places two bands of fertilizer in the bed as it is being formed. The width and depth of the placement is easily regulated.

Several different methods of application have been developed, each with its own individual merits and advantages. A brief discussion on some of these follows:

1. Anhydrous ammonia or liquid fertilizer in the irrigation water, applied before the crop is planted. In the San Joaquin Valley, where pre-irrigation is necessary, this is an easy and inexpensive method of application, which is widely used.

2. Placing the fertilizer in the beds before planting. The simplest method of doing this is the fertilizer lister that performs the two operations at once. In the San Joaquin Valley, where large equipment is common, the chiseling, listing and fertilizing are all done at once. The fertilizer can be placed in either one or two bands in the bed at whatever depth or spacing is desired.

If a fertilizer lister is not available, the standard side dressing equipment mounted on a wheel tractor can be used after the beds are formed.



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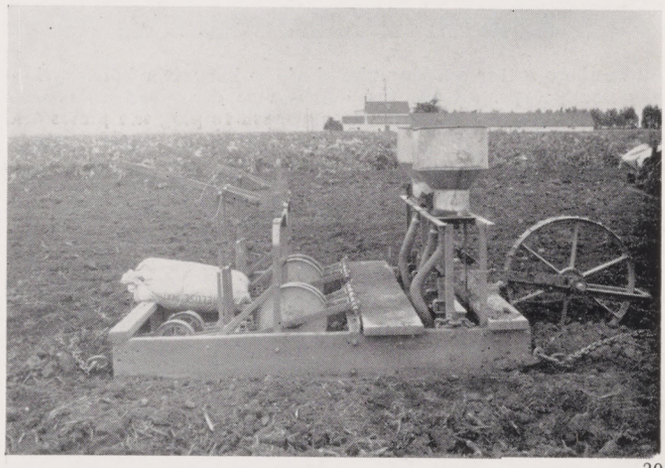
Photograph courtesy John Deere Plow Co.

Applying commercial fertilizer prior to planting sugar beets. The fertilizer drill places the material so that it will be from 2 to 4 inches below the seed when planted. Amounts up to approximately 85 pounds of nitrogen per acre are used at the time of this operation.

3. Planters with fertilizer attachments. Some growers prefer the more accurate placement of fertilizer in relation to the seed and have equipped their planters with fertilizer attachments. Both the sled and wheel type planters can be supplied with these attachments. The fertilizer should be placed below and to the side of the seed, and not in proximity to the seed.



20

Simple fertilizer attachment for application and planting in one operation.

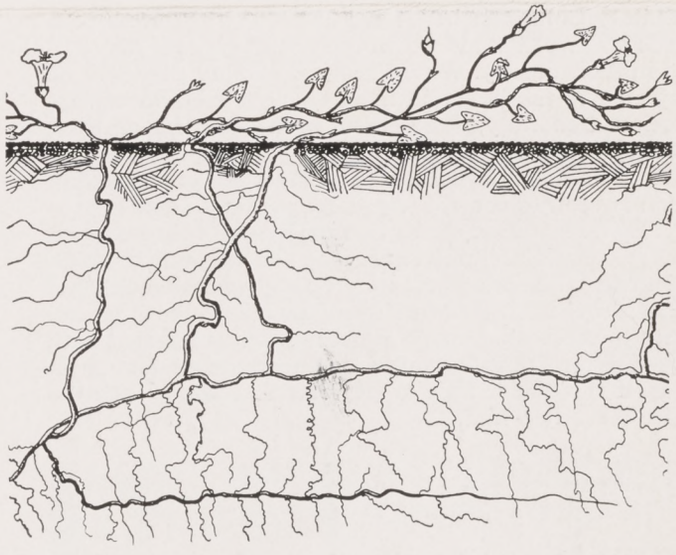
4. Broadcasting or using grain drills. These methods have never been as popular in any of the beet growing areas as most growers have obtained best results from concentrating the fertilizer in bands near the beet row. With such fertilizers, however, as cyanimide, which also acts as a weed control, this is the customary method of application.

SPRECKELS SUGAR BEET BULLETIN

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. X MARCH-APRIL 1946 No. 2

CONTROL OF WEEDS IMPROVES PRODUCTION OF SUGAR BEETS



Drawings by Bradley Vaughan, Sacramento District Office

ANNUAL WEEDS

1. Live only one year.
2. Spread by seeds alone.
3. Controlled by prevention of seeding.

- Watergrass
- Puncture Vine
- Mustard
- Mallow (Common)
- Pigweed
- Yellow Star Thistle
- Knot Weed
- Fiddleneck

PERENNIAL WEEDS

1. Live three years or more.
2. Spread by seeds and underground roots.
3. Controlled by killing root system.

- Morning-glory
- Johnson Grass
- Bermuda Grass
- Hoary Cress
- Alkali Mallow
- Bull Thistle
- Canada Thistle
- Nut Grass

AGRICULTURAL COMMISSIONER AIDS IN WEED CONTROL

By CHAS. H. HARDY, *County Agricultural Commissioner, Yolo County*

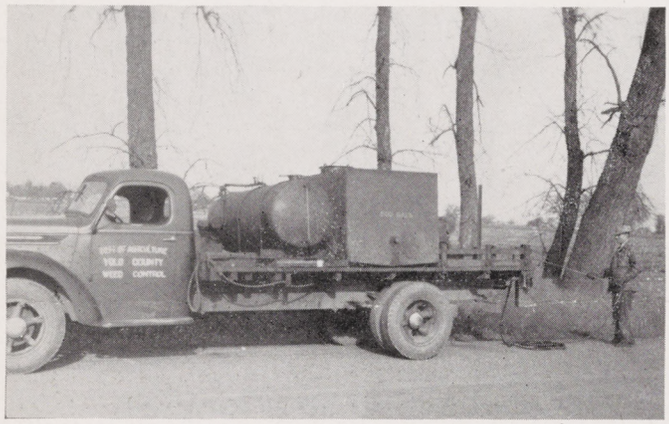
Weeds are silent enemies of our soils. They are gradually extending their forces like a vast army invading our fertile agricultural lands. Weed problems are of prime importance in every one of the fifty-eight counties in California.

From the County Agricultural Commissioner's point of view, a noxious weed constitutes a definite pest problem which must be controlled or eradicated. By state law, the Agricultural Commissioner is designated, as a State Plant Quarantine Officer, with the official duty of preventing the introduction and spread of weed or weed seed pests in the state.

Adequate state laws permit him to inspect all incoming shipments of any material which might contain any weed or seed pest.

County Commissioners have declared a list of noxious weeds and weed seeds which are not of general distribution in their county. Where these are found they will be subjected to the best and most efficient method of suppression. Generally, weeds have been taken for granted, but they are controllable.

Most counties have their own weed spray equipment, which is used to control weeds on publicly owned property. By a resolution of the County Board of Supervisors, the Agricultural Commissioner may use this equipment on a contractual basis on private property where weed pests warrant such action. Agricultural law allows the Commissioner to serve abatement notices on lands infested with a weed or seed pest that might be disseminated onto clean areas, if the owner fails or neglects to comply with the notice served on him.



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Weed spraying equipment owned by the Yolo County Department of Agriculture is used to control weeds on publicly owned property and also on a contractual basis on private property when the weed infestation warrants such an action.

The purpose motivating the work of weed control is to find any new weed and stamp it out before any sizable area has become infested. Further legal precautions are provided by the use of "Hold Notices" which require that a crop infested with a weed pest may not be removed until control measures have been used to the satisfaction of the Commissioner.

Many people do not realize that all seed screenings containing noxious weed seeds must be rendered nonviable before they can be used as feed or fertilizer.

All commercial weed pest control operators are required to pass successfully an examination before they may operate in the county to protect the farmers from unscrupulous "fly-by-night" operators, who are here today and gone tomorrow. As an added precaution, a pest control operator is required to notify the Agricultural Commissioner's office prior to each job so that check of the crop, equipment, the amount of material used and weather will insure satisfactory work.

BECOME WEED CONSCIOUS

The important factor is to get farmers "weed conscious," and in bringing this about, county weed committees have been of material aid in promoting a definite weed program.

Within the next few years marked inroads will be made upon the weed pests, due to improved materials and methods of control as well as better organized effort.

CHEMICAL METHODS OF WEED CONTROL

By W. W. ROBBINS, *Division of Botany, College of Agriculture, University of California, Davis*

Many methods of weed control and weed eradication are available. For example, there are (1) *mechanical methods,* including hand pulling, hoeing, tillage, mowing, flooding, burning, and smothering with non-living materials; (2) *cropping* and *competition methods;* (3) *biological methods,* involving the use of parasites; and (4) *chemical methods.* This discussion deals wholly with chemical methods of weed control. We are often prone to exaggerate the effectiveness of such methods, and use them when other means of control are just as efficient and less costly. Good farming, including clean seed, crop rotation, clean cultivation and timely operations, is usually the cheapest and most reliable method of weed control. Chemicals, however, have their place and may be indispensable for controlling small initial infestations, for cleaning up the last few plants after tillage and cropping methods have been used, and for special types of weed infestations. And, in using chemicals, it should be kept in mind that the costs of weed control should be charged against the total acreage and not against the infested areas alone.

What weed killers (herbicides) are now available, and what use can and should be made of them?

GENERAL NON-SELECTIVE CONTACT HERBICIDES

These kill the top growth of all plants, both crop plants and weeds, to which they are applied. The chemicals are not carried by the plant to the roots and rootstocks underground; hence, they are not useful in effecting more than a top kill, and cannot be employed to eradicate perennial weeds. The principal non-selective contact herbicides include petroleum oils (chiefly diesel oil and stove oil) and certain of their derivatives, such salts as sodium arsenite, sodium chlorate and ammonium sulfamate, and fuel oils fortified with dinitro-ortho-cresol or with dinitro-ortho-secondary butyl phenol (Dow Contact Herbicide). These herbicides are commonly used to destroy the top growth of all sorts of weeds, including grasses, growing along roadsides, fence lines, ditch banks, and in other situations where no vegetative covering is desired.

SELECTIVE HERBICIDES

These kill the top growth of certain species in a mixture of plants and leave others relatively free of injury. Sinox is now used widely to control broad-leaved weeds chiefly in cereals, flax, peas, onions, and garlic. A weed-killer similar in its action to Sinox will soon be available under the name of Dow Contact Herbicide. Stove oil is employed

(Continued on page 16)

CHEMICALS AND OILS USED BY MONTEREY COUNTY GROWERS FOR WEED CONTROL

By BLAINE KONKRIGHT, *Assistant County Agent, Monterey County*

Weed control is rapidly becoming a standard practice in farming operations, just as the planting of seed, the cultivation of crops, or the fertilization and upkeep of the soil. During the past ten years, farmers have become more aware of their weed problems, and because of this a greater emphasis has been placed on the eradication of all types of noxious weeds.

Chemical companies and universities have attempted to develop new chemicals and methods of controlling weeds, not only because of the damage done to crops in the form of competition, but because they serve as excellent breeding reservoirs for insects and plant-borne diseases.

Weeds are divided into three classes: The annuals, which consist of wild mustard, radish, puncture vine, dodder, nightshade and tarweed, live one year. The second class of weeds is the biennials, which produce seed the second year and are not too common in Monterey County. The third class consists of morning-glory, hell weed (hoary cress), Johnson grass, Russian knapweed and poison oak. These are known as perennials and live three years or more.

METHODS OF CONTROL

Cultural methods are some of the oldest methods of weed control. Following are a few suggestions for the eradication and control of weeds before they become established:

1. Use clean seed.
2. Do not use screenings or grain infested with weed seed.
3. Know your species of weeds and learn eradication practices.
4. Do not allow portable grain cleaners or harvesters on ranch unless clean and free from weed seeds.
5. Do not use manures from weed-infested areas.
6. Prevent seeding by cultivation, mowing, burning, chemical treatment.
7. Use fast growing cover crops to smother out seed stands.
8. Clean cultivation. Cultivate only the infested area so as to prevent spread of perennials. Also, cultivate whenever new growth appears.
9. Summer fallow grain fields.

CHEMICAL CONTROL

One of the most widely publicized weed killers is the new hormone weed spray 2,4-D (2-4-dichloro-phenoxyacetic acid). This weed killer is still in the experimental stage and as yet is not recommended by the University of California for wide and extensive use for control of all weeds.

2,4-D is available as a liquid and as a powder. The liquid preparations usually contain about 9.6 per cent of the 2-4 dichloro-phenoxyacetic acid plus an emulsifying agent. One gallon of the liquid 9.6 per cent 2,4-D makes approximately a .1 per cent solution when diluted to 100 gallons of water, or a .2 per cent solution when diluted to 50 gallons of water.

Salts of the parent acid or sodium or ammonium salts are readily prepared and are dry powders. The powder concentrations on the market contain 60 per cent of the sodium salt of the acid plus wetting agents, which improve the uniformity and coverage of the plants sprayed. One and one-half (1½) pounds of 60 per cent sodium salt is equivalent to 1 gallon of the 9.6 per cent liquid.

MODE OF ACTION

The method by which this chemical kills the plants is different from most weed killers. It was first used as a hormone or growth regulating substance. However, higher concentrations were observed to kill plants, thus laying the ground work for weed control.

The first effect on sprayed plants is a twisting and bending of stems and leaves. Different plants react in different ways. Some dry up completely; others are stimulated for a short period, then die. As a general rule, cells thicken and oftentimes will crack open. Roots will become soft and spongy two or three weeks after treatment, or as soon as the material is translocated or pulled down into the root system. Four to eight weeks or longer, may be required to kill the weed.

WEEDS TREATED

Morning-glory is one of the easiest to kill. In Monterey County it should be sprayed in the spring of the year when the plant is at the peak of its new growing cycle.

White top or *hoary cress* is a more difficult weed to kill and may require larger amounts of chemical. To date results have not been too good on hoary cress.

Canada thistle sprayed with 2,4-D gave satisfactory results in the first year's trials.

Poison oak and *blackberry* showed stimulation in first treatments. These plants should be sprayed in the spring of the year when they are green and fast growing. A 2 per cent oil solution may be necessary.

Gaura, milk thistle, bull thistle, sow thistle, mustard, fennel, chickweed, artichoke thistle and others are showing some promise when sprayed with this hormone, but further work must be done.

(Continued on next page)

RIDGE PLANTING VS. WATER GRASS

Ridge planting in the Sacramento Valley has proven to be beneficial in the combating of water grass. It was noticed that the sprouting of seed was confined to the area of the furrows which had the water standing for a longer period of time, whereas the top of the bed which drained rapidly and upon which irrigation water was not applied was free of water grass.

This wide furrow area lends itself to late cultivations and an opportunity to keep the late growth of water grass in check.

CHEMICALS AND OILS (Continued from page 11)

Control of *cattails* and *tules* also has shown promise with the addition of 4 gallons of diesel oil per 100 gallons of water plus 2 pounds of 2,4-D.

Willows have been killed with one spraying in Monterey County; however, two sprays will probably be necessary, followed by a bulldozer and burning.

EFFECT ON GRASSES

Grasses seem to be more resistant to 2,4-D than most broad-leafed plants. Because of this, it is possible to use 2,4-D on lawns for control of dandelions. Use ½ gallon of .1 per cent solution to 100 square feet. According to university trials, bluegrass and rye grass are more resistant than bent or red top. In time 2,4-D may be used with cereals, but to date no recommendation can be made.

WHEN TO SPRAY

Spraying should be done in the spring months when weeds are lush and at peak of growth. Do not spray in cold weather or when plants are old or approaching maturity. If sprayed too early, many plants will recover.

PRECAUTIONS

2,4-D is a new chemical still in the experimental stage; many of the claims made for this material are not altogether true. Consumers should use it with care. In Monterey County partial soil sterilization has been observed up to four months, and cabbage has been planted as many as three times in soil sprayed with 2,4-D.

Spray equipment should be thoroughly washed out after being used with 2,4-D or adverse results will be obtained when using the spray machine with other chemicals. Rinsing is not sufficient with cold water. Add baking soda to the wash water.

COST OF APPLICATION

The cost of application depends upon the type of material used; whether a liquid or dry powder concentration.

Optimum concentrations of 2,4-D have not as yet been worked out for all weeds; however, a .1 per cent or .2 per cent solution, applied at the rate of 100 to 400 gallons per acre, is usually sufficient for most weeds and will usually determine the cost.

OTHER CHEMICALS

Sulphuric acid, sodium chlorate and *sodium arsenite* are chemicals that are not always practical, due to the excess cost and the danger to human beings and livestock.

Carbon bisulfide and *borax* are two materials that have been used quite extensively. Carbon bisulfide on morning-glory is applied at the rate of 2 ounces to an 8-inch deep hole, staggered at 18-inch intervals. Seal hole by tamping. This material sterilizes the soil for about two months and it costs about $200 to treat an acre.

Sinox, stove oil and *diesel fuel* are weed killing agents used on specific crops, such as carrots, onions and celery, and are used, as a general rule, when the cotyledons and first and second leaves are breaking through the soil in order to control weeds at the time of plant emergence.

SUMMARY

The three classes of weeds, annuals, biennials and perennials, may be controlled by a combination of cultural practices and chemical control. Growers should keep in mind that no matter how adequate or complete the chemical, control will not be obtained unless weeds are thoroughly and completely sprayed.

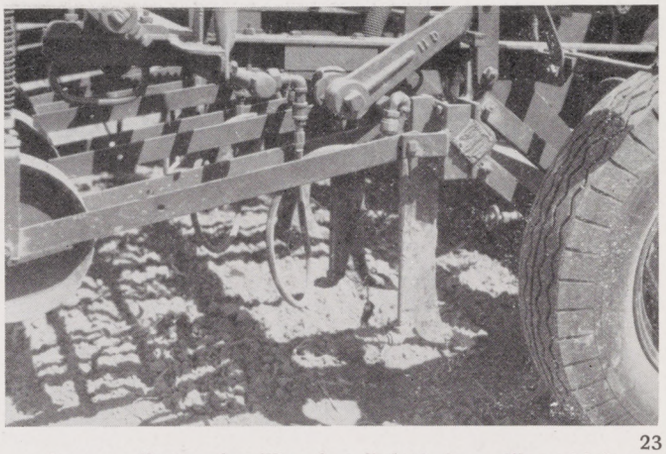
For further information as to exact dosages, family of weeds involved, and time to spray, growers are advised to contact their local Spreckels field man or members of the Agricultural Extension Service, Court House, Salinas.

SOIL FUMIGANTS IN THE SALINAS VALLEY

By C. E. CRANE, *Agricultural Department, Spreckels Sugar Company*

For many years, yields of all crops have been reduced in certain fields and areas in the Salinas Valley because of garden nematode, sugar beet nematode, wireworm or centipede. Through the years, some lands have become so infested with one or more of these pests that crop production has been reduced considerably below normal.

At the present time there are two materials which give promise of controlling these pests. One of these consists of a mixture of unsaturated chlorinated hydrocarbons, known to the trade as *DD*.[1] DD has shown great promise for the control of sugar beet nematode as well as other soil borne pests. The second material is ethylene dibromide, known as *Dowfume G*. While experience with this material in the Salinas Valley for nematode control is very limited, tests have shown excellent results for the control of other soil borne pests.



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Dow applicator for "Dowfume" (ethylene dibromide) showing fumigation nozzles back of the shoes.

Both of the above materials are applied as a liquid, released underground from a tractor drawn chisel through tubes fastened to the back side of the chisel standards. A large tank carrying the material is mounted on the chisel and the material is fed to the tubes by a pressure pump to assure uniform application. The tubes release the material in the soil at a depth of 6-10 inches, with the chisels and tubes spaced 12 inches apart.

Before applying the material, the soil should be loose and free of clods so that the chisels can be easily held at a uniform depth. A drag or roller should be pulled behind the chisel to pack the surface soil in order to prevent the escape of the material.

These materials are applied at the rate of 250-400 pounds per acre, depending upon the degree of infestation and type of pest.

TEST ON CONTROL OF WIREWORMS IN BEAN CROP

A test was conducted by the Spreckels Sugar Company at King City, California, in 1945, for the control of wireworms, using both DD (at the rate of 400 pounds per acre) and Dowfume (at the rate of 260 pounds per acre) applied two weeks prior to planting a bean crop. After ten days an examination of the plots showed that almost 100 per cent of the wireworms were killed in the DD plots and 85 per cent in the plots receiving Dowfume. After the beans had emerged, it was evident that good control had been obtained in both plots because of the excellent stands obtained, while poor stands were obtained in the untreated plots.

(Continued on next page)

[1] Dichloropropylene-Dichloropropane mixture.

Later in the season, just before the bean vines began closing over the rows, it was noted that the beans in the Dowfume-treated plots had 3-4 inches more vine growth than in any of the remaining portions of the field. We are informed this observation has been noticed in other tests.

TEST ON CONTROL OF SUGAR BEET NEMATODE AND WIREWORMS ON LETTUCE CROP

Another test was conducted by the Spreckels Sugar Company near Salinas using both DD and Dowfume on soils containing sugar beet nematode and wireworms.

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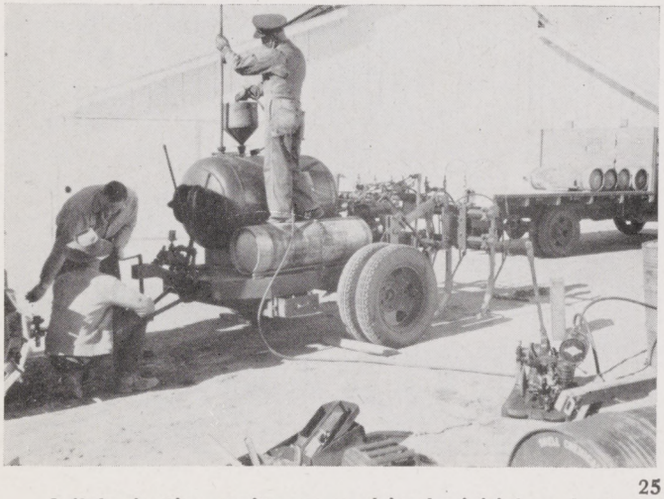
Field of lettuce attacked by wireworms. The area in the foreground has not been treated. In the background may be seen the untreated strips alternating with strip treatments of EDB ("Dowfume"—ethylene dibromide) and strip treatments of DD.

Various dosages of these materials were used from 250-400 pounds per acre and the field was planted to lettuce ten to twelve days after treatment. While good stands were secured on the treated and untreated plots, as the season progressed the stands in the untreated plots became thinner and thinner as the wireworms destroyed the stands, while good stands were maintained in the plots treated with both the materials.

At harvest, approximately 95 per cent of the lettuce heads in the treated plots were harvestable as compared with 70-75 per cent of the heads in the untreated plots.



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Soil fumigation equipment used in the initial work of applying DD.

AVERAGE NUMBER OF FIELD-RUN CRATES OF LETTUCE SECURED FROM THE VARIOUS PLOTS

Check plots	69 crates
Dowfume plots	289 crates
DD plots	408 crates

A number of tests have been conducted in the Salinas Valley during the past season under the direction of Mr. Blaine Konkright, Assistant Farm Advisor of Monterey County, with the advice and help of Dr. William H. Lange, Division of Entomology, University of California, and his assistant at Salinas. In addition, commercial applications were made on fields subsequently planted to vegetables, principally to control wireworms and centipedes. It is reported that from 2,500-3,000 acres in the Salinas Valley have been or will be treated this year with DD and Dowfume, because of the excellent results which have been secured in past tests.

In addition, Mr. Konkright, in conjunction with the Dow Chemical Company and the Shell Chemical Company, has laid out two extensive plots on nematode infested land to gather additional information on rates and depth of application in order to obtain maximum control of nematode.

PRE-EMERGENCE SPRAYING FOR WEED CONTROL

By WALTER S. BALL, *Chief of the Bureau of Weed and Rodent Control, California State Department of Agriculture*

Weeds, through competition and interference with the production of various crops, present many problems. The farmer, who is confronted with these problems, readily realizes there is no one recommendation or easy way to solve this ever-present weed control menace. Pre-emergence spraying is just one other means of approach in this extensive program. Although a new venture, it is thought to have a place.

Spraying for the control of weeds before the crop plants emerge through the surface of the soil has proved successful in a few instances, and has opened a field worthy of further investigation and research.

This practice will necessitate more careful planning of seed bed preparation and time of planting, as the objective in this method is to allow time for the germination of weed seed prior to the emergence of the crop plant. There should be two or more days between the final seed bed preparation and the planting of the crop seed. This will give time for many species of weed seeds to germinate and to be above the soil surface before the crop plant comes through. The time between seed bed preparation and planting can be governed to some degree by the known period needed for the germination of the crop seed planted. Field observations show that under optimum conditions a large number of the annual species of weeds germinate in rather a short time.

While the selective spray program for the control of broad-leaf plants in such crops as onions and garlic has resulted in a saving to the grower as compared with hand weeding, this method has not controlled grasses. In many instances these are as serious weed pests as are the broad-leaf species. Grasses required about the same time for germination as the onions, and pre-emergence spraying could possibly be worked out for the control of annual grass by preparing the seed bed five to six days prior to planting.

The application of a contact spray two or more days before emergence of the crop will eliminate those weeds above the surface. It has been shown that the elimination

(Continued on next page)

SPRAYING *(Continued from preceding page)*

of this first crop of weeds has greatly reduced competition for light, moisture and food needed for the establishment of strong crop plants.

In certain of the vegetable crops the cost of hand weeding could be greatly reduced through this practice. This has been demonstrated in the case of carrots, and especially celery seed beds.

Field practices in the selective spray programs have shown that herbicides may be applied at rates as low as 60 gallons per acre, through proper calibration of equipment. At this rate there should be no residual effect of the material on the soil, which could cause injury to seedlings of crop plants.

The possibility of new herbicides that may be used as contact sprays is very probable. A number of the plant regulating substances are proving to be effective weed killers. The cost of the spray material should be very reasonable, due to the small amounts of these materials needed for the control of certain weeds.

The method of pre-emergence sprays is a new adventure, so to speak, in the field of weed control, but while it has possibilities of assuming a very important place in the field of weed control, it is not the answer to all weed problems.

In order for this type of program to be most practical and beneficial to the growers of California, more information must be made available relative to the seed of the weeds commonly found in areas where it can be applied. The time required for germination of the weed seed as compared with the seed of the crop involved is of primary importance. Contact sprays of different types should be given greater attention in order to insure that the most effective and practical one is used for the weed problem involved. Grasses, for example, would have to be treated with a non-selective spray, while such a spray would control broad-leaf plants satisfactorily.

Weed control presents very extensive and varied problems. *Weed research* and *education* are of major importance; of these two, research comes first.

New ideas and the approach to problems, such as pre-emergence spraying for weed control, must be worked out carefully with adequate field tests. Pre-emergence spray will work out successfully only when all known factors are given consideration. There is more to be learned through research before the extension of its application.

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The ditch bank area on the left side of the picture has been burned with the use of the weed burner developed by Frank Kellogg. The area on the right is untouched.

gallon tank mounted on skids. A Star motor is used to develop pressure and the entire assembly may be placed on any one of several vehicles on the ranch. The burner unit is equipped with a 30-foot boom which was constructed of pipe, beginning with 2-inch pipe and gradually reducing to ¾-inch. The line for fuel is welded along the lower side of the boom. The boom is mounted on a swivel and pivot and is counterbalanced to facilitate handling. There are four nozzles spaced 18 inches apart on the end of the boom.

A similar weed burner can be built in any farm shop for $250 or more, depending on the type and age of the motor used. The motor should be capable of developing at least 10 H.P. to obtain 200 pounds of pressure or more in the fuel tank. A 300-gallon tank furnishes sufficient fuel for approximately three hours as the burner consumes about 100 gallons of the fuel per hour. Diesel fuel is used and is very satisfactory.

With this type of weed burner, the length of the boom is important since it is difficult to manipulate if it is too long. However, the boom must be long enough to keep the heat of the flame away from the operator. In tall, rank growth a satisfactory burning job can be done by traveling at three miles per hour; however, on short new growth in the spring a better burning job can be done at a speed of five miles per hour. Burning can be done at any time of the year, but the most satisfactory work is accomplished when weed growth is from 4 to 6 inches in height.

NEW WEED BURNER FOR BANKS

By R. E. FLORES, *Agricultural Department, Spreckels Sugar Company*

Many sugar beet growing areas contain large drainage ditches, which are badly overgrown with weeds. Besides being unsightly, weedy ditch banks generally become breeding grounds for many of the insect pests infesting agricultural crops. In addition, when the weeds become mature, seed from them is disseminated over the adjacent fields. Several methods have been devised to control weeds on ditch banks, some of which require considerable time and cost. One of the least costly methods includes weed burning.

A new type of weed burner, which is economical, speedy and efficient, has been constructed by Mr. Frank Kellogg, of Sears Bros. and Co., at Watsonville. This burner consists of a 300-

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New type of weed burner developed by Frank Kellogg, of Sears Bros. and Co., Watsonville. This burner is economical, speedy and efficient

EQUIPMENT FOR SPRAYING WEEDS

By W. A. HARVEY, *Division of Botany, College of Agriculture, University of California, Davis*

Increasing use is being made of chemical sprays for killing weeds. The shortage of labor and the development of new chemicals have contributed to the importance of this practice. Many growers have sprayers previously used for controlling insects and fungus pests. These sprayers can be easily adapted to spraying weeds.

Depending on the particular weed problem involved, equipment for spraying weeds may be used for the application of a wide variety of chemicals at volumes ranging between 30 to 400 gallons per acre.

PUMP

The type of pump used for spraying weeds is of slight importance as long as it will supply the required volume of spray at a pressure of about 100 pounds per square inch. High-pressure orchard spray pumps are not necessary but can be used if the pressure is reduced. The current tendency is toward the use of rotary, centrifugal, and turbine type pumps, which are lighter in weight and less expensive than corresponding sizes of orchard spray pumps. Ordinarily, the largest size needed would be a 50 or 60 gallon per minute pump for large scale spraying with a 40- or 50-foot boom. For a hand boom or shorter field boom a corresponding smaller pump would be required.

Power may be supplied to the pump from an auxiliary motor or from a power take-off. However, the power unit must have sufficient power and speed to drive the pump the required revolutions per minute.

An entirely different principle is involved in the Essick Weed Sprayer which has been widely used for oil spraying in citrus groves, but is equally adapted for other weed spraying. In this machine the spray solution is contained in a pressure-tight tank from which it is forced by air pressure developed from a compressor and gasoline engine mounted on the tank. The spray solution thus does not go through a pump and if the compressor is protected against dirt by an air filter there is little to wear on the machine. Some models are fitted with a built-inair agitator, since mechanical agitation is difficult in the sealed tank. A pressure of about 75 pounds per square inch is maintained on the solution. The following discussions apply only in part to such a machine, since it comes equipped with tank, boom, etc.

TANK

The tank to contain the spray solution should preferably be of metal, since such tanks are easier to clean and less subject to leaking. Wooden tanks soak up the spray solution and if later used for other spraying may contain sufficient weed killer to cause damage.

The size of the tank will depend upon the capacity of the pump. For a small pump delivering 3 to 5 gallons per minute and using a hand boom, a 50-gallon oil drum is sufficiently large. For field spraying with a large pump and long boom, a tank of 1,000 gallons capacity may not be too large. In general, if water is readily available and the fields are small, a tank of 300 or 400 gallons capacity is sufficient.

If mixed sprays are to be used it is essential that the tank have an agitator to mix the solution thoroughly. The usual agitator consists of a row of paddles on a shaft reaching through the tank and driven from one end of a belt or chain drive from the engine driving the pump.

THE BOOM

The boom should be connected to the pump with as large size pipe and hose and as few elbows as is feasible. If the pump is tapped for 1-inch pipe, use 1-inch pipe and hose to the boom.

Spray booms are frequently made in three sections—a center section mounted on the sprayer or tractor and two side sections hinged to the center section so that they may be easily folded in for transportation or for passing through gates. The side sections should be supported both vertically and horizontally to prevent whipping. Booms for spraying grain fields, ditch banks, etc., are often extended to one side only of the sprayer. For spraying row crops the boom is often suspended beneath a wheel tractor where the driver may observe the operation.

The length of the boom will depend on the size of the spray pump and upon the area to be sprayed. For open level fields 30 to 50 feet of boom is not unusual. For vegetable spraying, a definite number of beds is sprayed. Thus, with 40-inch beds the boom may be 40 inches, 80 inches, 120 inches, or any multiple of the 40-inch bed width. On uneven ground the length of boom should be reduced to a convenient length to maintain approximately the selected height above the ground for the entire boom length and to prevent whipping of the ends of the boom. One-inch heavy pipe is sufficient for booms up to 15 feet in length. For longer booms 1¼-inch or even 1½-inch pipe may be preferable.

Since most spray nozzles have ¼-inch pipe threads, either male or female, ¼-inch pipe fittings are used for connecting the nozzles to the boom. If the outlets are tapped into the sides or top of the boom, the lower half of the boom will serve as a sump to catch particles of scale or sand which might otherwise clog the nozzles. By tapping alternate nozzles into opposite sides of the boom there is less weakening of the pipe and the edges of the adjacent spray fans pass without interference.

Outlets may be made in several ways: (1) Drill and tap the boom for ¼-inch pipe threads; screw in a nipple or a street elbow (depending on whether the nozzles have male or female threads). (2) Weld ½ or a ¼-inch coupling over the hole in the boom. This provides more threads and a stronger joint. (3) Drill a hole slightly larger than ¼-inch pipe, insert a nipple, and weld. (4) Spot and elbow over the hole and weld in place.

SHUT-OFF VALVE

A quick-opening gate valve should be placed in the pressure line leading to the boom, in a position easily reached by the operator. This valve should be imme-

(Continued on next page)

SPRAY EQUIPMENT (Continued from preceding page)

diately closed when the sprayer is stopped in the field, for an excess of the spray in one place may injure the crop.

NOZZLES

A flat, fan-shaped spray is preferred to a cone-shaped spray for spraying weeds. The distribution of spray solution across the swath covered by each nozzle is more uniform with a good flat spray than with a cone spray.

SPACING THE NOZZLES

For spraying row crops, the nozzles should be spaced on the boom so that there is one centered over each row. Adjust the boom to the height where the edges of the spray fans meet midway between the rows. Avoid having the heavy edges of spray fans hit directly on any row.

For spraying grain or solid infestations of weeds, the nozzles should be spaced uniformly on the boom at 12, 15 or 18-inch spacing to give complete coverage of the foliage. The exact spacing to be used will depend upon the nozzles used and the weed growth. The nozzles should be so spaced that the edges of the spray fans just meet. It is frequently preferable to have alternate fans meet, thus giving double coverage. If this is done, alternate nozzles should be staggered so that the spray fans are in different planes. This can be done by tapping the alternate nozzles into opposite sides of the boom or by using different length nipples for alternate nozzles. There is apparently some advantage in tilting the nozzles slightly so that with double coverage the spray fans hit the weeds at slightly different angles.

HAND BOOM

There are many places and conditions, such as fence rows, small scattered weed patches, around buildings, etc., where a field spraying boom is not practical. For such areas a hand boom of one or two nozzles is used. Such a hand boom can be purchased or built out of iron pipe and fittings. A 4 or 5-foot piece of ¼ or ½-inch pipe is fitted with a valve and hose connection at one end. The other end is fitted with a 45° elbow into which a single nozzle can be attached. For the usual double nozzle type a tee connects to the 45° elbow and two long nipples reach from the tee to street ells on which the nozzles are attached. The length of the nipples determine the distance between the two nozzles. In general, more spray will be used with a hand boom and the coverage will be less uniform than with a field boom.

CHEMICAL WEED CONTROL (Continued from page 10)

as a selective spray in carrots and other representatives of the family of plants to which carrots belong. The new weed killing chemical, 2,4-D, shows great promise as a selective spray, particularly in cereal crops. Grasses, in general, are much more resistant to 2,4-D than are broad-leaved plants. Reports from Great Britain indicate that 2,4-D may also be applied as an amendment to the soil at the time of planting cereals to kill susceptible weeds as the seeds germinate.

HERBICIDES USEFUL IN THE CONTROL OF PERENNIAL WEEDS

The control of such perennials as wild morning-glory, hoary cress, Johnson grass, Bermuda grass, Canada thistle, Russian knapweed, and nut grass presents very special problems. *Carbon disulfide* is recognized as one of the most effective herbicides for controlling such perennials as listed above. It has no deleterious effect upon the soil, a distinct advantage on intensely cropped land. Though seldom justified in very large-scale weed control, it is recommended to prevent the spread of small infestations, and for clean-up after large-scale cultural or cropping programs. *Sodium chlorate, ammonium sulfamate* (Ammate), and *boron compounds* are also used to control perennial weeds, but, in comparison with carbon disulfide, they have more lasting effects upon the soil.

Recently, *2,4-D* has attracted attention as an herbicide which may be used to control perennial weeds. The mode of action of this new chemical is quite different from that of other weed killers. It works slowly, four to eight weeks being required for the weeds to die down completely. The more susceptible perennial weeds are Canada thistle, cattail, dandelion, lens-podded hoary cress, Klamath weed, and wild morning-glory; the more resistant perennials are alkali mallow, Johnson grass and Russian knapweed. 2,4-D is now available either in liquid or dry form. The optimum concentrations and rates of application, and hence the costs, have not been definitely determined for many weeds under California conditions. It is definitely known that 2,4-D does have some residual effect in the soil. How long the effect will last and how serious it will be depends on soil type, temperature, rainfall or irrigation, and the crop planted. Some injuries have resulted to useful plants from the spray drifting, or from using a sprayer which has not been thoroughly washed out after it contained 2,4-D.

SOIL STERILIZATION

In most agricultural and industrial regions, there are many places where all plant growth is objectionable; for example, along railway roadbeds, along fences, irrigation ditch banks, parking areas, mill yards, about signboards, airports, telephone and power-line poles, and playgrounds. Chemical treatments are available which render such areas sterile for a number of years, making unnecessary frequent hoeing, knifing, burning, or other costly operations. The three chemicals—arsenic, borates, and chlorates—represent the most generally available and readily useful soil sterilants. They are used separately or in various combinations. Their effectiveness depends upon the fixing power of the soil to which they are applied, to rainfall, and other factors.

There are many conditions—soil, climate, cropping, nature of infestation—which must be considered in deciding upon a program of chemical weed control. The foregoing brief discussion is obviously inadequate as a guide in making applications of specific herbicides to specific weeds. Therefore, there follows a list of available publications which may be secured by writing to the Division of Botany, University Farm, Davis, California:

Weed Control, Circular 97, Calif. Agri. Exten. Service. Revised December, 1940.

Herbicidal use of carbon disulfide, Bulletin 693, Calif. Agri. Expt. Sta., October, 1945.

Growth-regulation substances as weed killers. (Mimeographed.) Revised November, 1945.

Chemical weeding of carrots with stove oil sprays. (Mimeographed.) Revised March, 1944.

Equipment for spraying weeds. (Mimeographed.) November, 1945.

Control of aquatic weeds. (Mimeographed.) March, 1945.

Experiments on general contact herbicides. (Mimeographed.) May, 1944.

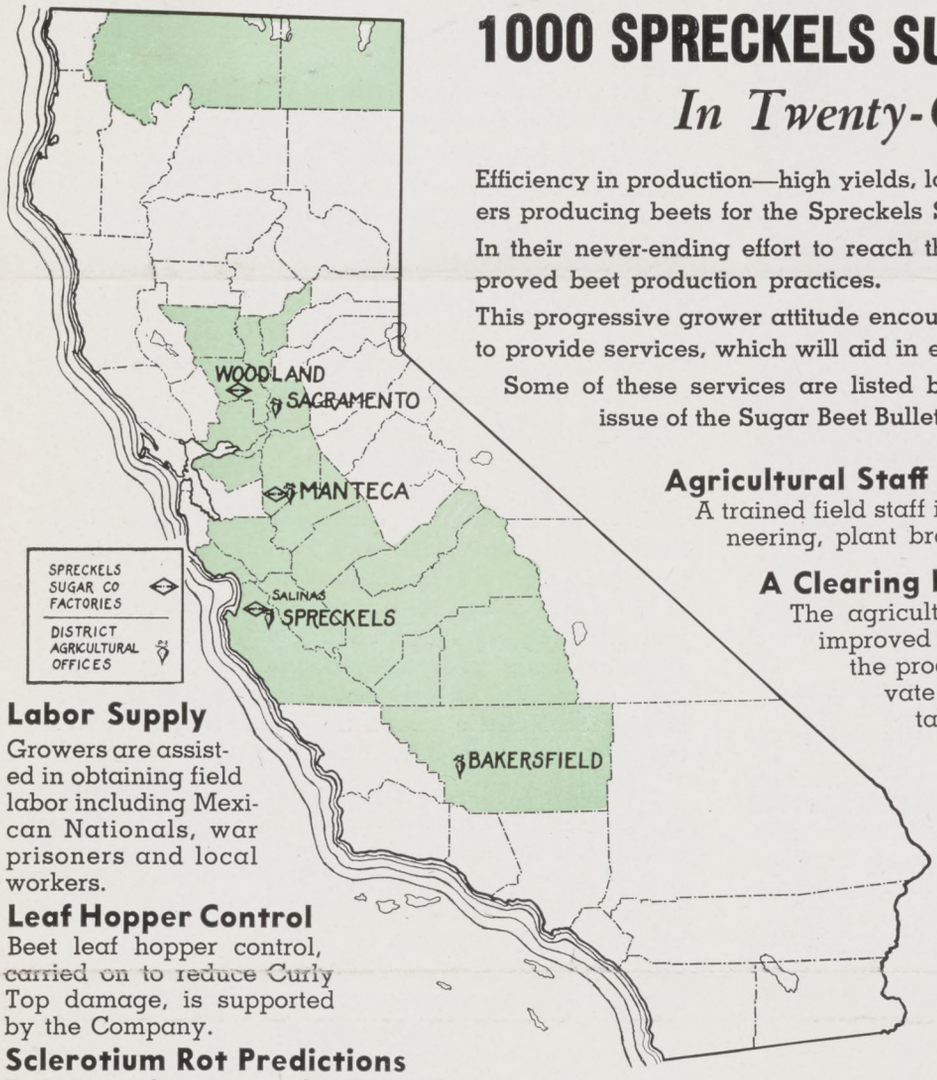
THIS ISSUE

The material for this issue of the Spreckels Sugar Beet Bulletin was assembled and edited by W. B. Marcum, Field Supt., with the assistance of H. J. Venning, Asst. Agricultural Supt., and J. B. Larsen, Field Supt.

SPRECKELS SUGAR BEET BULLETIN

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. X — MAY-JUNE 1946 — No. 3



1000 SPRECKELS SUGAR BEET GROWERS

In Twenty-One Counties

Efficiency in production—high yields, low production costs—is the goal of growers producing beets for the Spreckels Sugar Company.

In their never-ending effort to reach this goal they continually search for improved beet production practices.

This progressive grower attitude encourages the Company to an unusual effort to provide services, which will aid in efficient production.

Some of these services are listed below and are further described in this issue of the Sugar Beet Bulletin:

Agricultural Staff
A trained field staff including specialists in agricultural engineering, plant breeding, labor and livestock.

A Clearing House
The agricultural staff keeps currently informed on improved practices developed by growers and the progress of government, company, and private research activities so that growers may take immediate advantage of new ideas.

Labor Supply
Growers are assisted in obtaining field labor including Mexican Nationals, war prisoners and local workers.

Leaf Hopper Control
Beet leaf hopper control, carried on to reduce Curly Top damage, is supported by the Company.

Sclerotium Rot Predictions
To prevent heavy crop losses resulting from Sclerotium root rot, predictions of probable loss are made prior to planting by analyzing soil samples to determine presence of Sclerotia.

Seed Supply
Seed supplies of the improved varieties are available due to the development of domestic seed production.

Seed Preparation
Through advanced methods of shearing, grading and cleaning, high quality seed adapted to modern planting methods is made available to growers.

Variety Tests
Variety tests are conducted annually to determine the characteristics and adaptability of new beet varieties and to recheck those in commercial use.

Mechanical Harvest
A supply of mechanical beet harvesters is maintained for rental to growers.

Harvester Service
A staff of service men equipped and on call to repair and service harvesters in the field.

Research Projects
To obtain information which can be used to increase yields and lower production costs, research projects are conducted by the Agricultural Staff and contributions are made to government and private research organizations.

Plant Breeding
A plant breeder is employed to develop beet varieties more resistant to diseases and bolting, and which will yield more sugar per acre.

Spreckels Sugar Beet Bulletin
Current information on progress in beet production is supplied growers through the Bulletin.

Fertilizer Requirement Determinations
Field and laboratory tests are conducted to find a clue to the nutrient requirements of sugar beets and to provide a guide to fertilizer application.

For the 1946 harvest there will be a total of 91 Marbeet harvesters available for use by Spreckels growers. Of these 24 are one-row and 67 are two-row machines. Most growers are now convinced that the **MECHANIZED HARVEST PROGRAM** already is well on the way toward the solution of the always-troublesome harvest labor problem. That the Company is convinced is evidenced by its large investment in these machines. Through its **MARBEET HARVESTER RENTAL-PURCHASE PLAN** the Company makes it quite easy for a grower to acquire his own harvester by applying rentals paid for its use to the purchase price. Two or more growers may apply combined rentals toward purchase and own their harvester jointly. Interested growers may obtain full information through their field superintendent.

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Spreckels harvester service at work. This service saves much precious time by bringing the shop to the field. An expanded service set-up for keeping Marbeet harvesters working will feature the 1946 harvest.

This investment in harvest machinery, rental-purchase plan and the establishment of a **HARVESTER SERVICE** organization complete with service trucks, tow trucks, pickups, tools and equipment are all part of the Company's campaign to make the mechanized harvest attractive to the grower.

It was difficult to accomplish all this under wartime restrictions, but the lessons learned during this period will be reflected in the 1946 harvest. The service equipment for 1946 embraces the following items:

4—Heavy service trucks with arc and gas welding equipment, tools and full parts supply.

5—Light service trucks, with gas welder, tools and a supply of most often needed parts.

4—Tow trucks for transporting harvesters.

These service units will be stationed in areas of harvester activity and will operate on a schedule.

The 1946 Marbeet harvesters will be provided with steel chests so that a fair stock of expendable parts will be carried by each machine at all times. During their periodic visits the service trucks will replace worn and broken parts. Thus each harvester will always be provided with extra plow shares, topping knives, spikes, stripper knives, etc.

A very important part of the Company's policy is the yearly remodelling and modernization of the Marbeet harvesters incorporating improvements suggested by the manufacturer, the user and the Company's Agricultural Engineering Department. Because of this policy all machines available for rental during 1946 will be substantially 1946 models.

Growers producing beets for the Spreckels Sugar Company are vitally concerned in increasing beet yields and lowering production costs. They are unusually responsive to new ideas, which will result in more efficient production and are anxious to be kept informed on the latest developments resulting from other growers' experiences and the progress of research projects undertaken by company, government and private organizations.

To fulfill the desire of these growers for current information on progress in the industry and assistance in improving their production operations, Spreckels Sugar Company maintains an **AGRICULTURAL STAFF,** which devotes a large part of its time to rendering this assistance. The staff consists primarily of field superintendents, located in various areas in which beets are produced for the company, and specialists in Plant Breeding, Agricultural Engineering, Labor and Livestock.

Many improved practices have been and are being developed by beet growers, which are a definite contribution to improvement in the industry, and the acquainting of other growers with these practices is a part of the responsibility of the agricultural staff. Furthermore, it is important that the growers be kept informed as to the progress of research and development projects undertaken by government, company, and private groups and this, too, the agricultural staff undertakes to do. In this way, the agricultural staff, through the field superintendents and the Sugar Beet Bulletin, serves as a **CLEARING HOUSE** for the most current information of this type.

Notable examples of this sort of reporting are seen in the manner in which the work of Professor Roy Bainer on the development of segmented seed and that of Dr. Lysle Leach on sugar beet diseases have been brought to the grower's attention. In addition, important articles by other University men on fertilizers, irrigation problems, utilization of by-products for feed, and weed control, among others, have appeared in the Bulletin.

TEAM WORK

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A beet grower and a Spreckels Field Superintendent examine the result of a cross-blocking trial.

At the present time there are available to the grower of sugar beets varieties highly resistant to the attacks of the virus causing curly top. Unfortunately, these varieties are susceptible to the attacks of the organisms causing downy mildew, and bolt readily when planted in December or early January. It is therefore evident that one of the major objectives of the **PLANT BREEDING PROGRAM** should be to recombine by hybridization and subsequent selection the three desirable characters: resistance to the attacks of the virus causing curly top; resistance to the organism causing downy mildew; and resistance to the factors causing bolting. Since these three characters exist in separate varieties, it seems highly probable that such a variety can be created by hybridizing and subsequent selections.

DOWNY MILDEW

Even though we have commercial varieties, such as U. S. 15 and Improved U. S. 33, which carry a certain amount of resistance to the attacks of the organism causing downy mildew, there is need for a variety having still more resistance. Breeding work toward attaining this goal has been started. Last year selections of disease-free plants were made from a field of U. S. 15 that had an exceptionally high percentage of infected plants. These selections will be subjected further to epidemics of downy mildew in an attempt to obtain a variety of sugar beets highly resistant to the attacks of the disease causing the organism. There is much reason for optimism as to the successful conclusion of this part of the breeding program.

BOLTING

Also, it would be highly desirable to have a variety of sugar beet that could be planted in September and October without an undue amount of bolting occurring. This would require a degree of resistance to bolting much greater than that of U. S. 15, which is the most bolting resistant variety that we have today. Work to accomplish this end is in progress. Last summer (1945) intensive breeding work was started with U. S. 15 at Medford, Oregon. The progeny resulting from plantings (made in October) of the seed of this material is very encouraging.

LOWERING NUMBER OF SEED GERMS

Another problem susceptible to solution by breeding is that of lowering the number of germs per seed unit. At the present time the process known as seed shearing is being employed to reduce the number of germs per seed unit. Last summer selections were made in an attempt to attain this goal by breeding. Several individual plant selections were made, the seed of which upon emergence averaged 80 per cent single seedlings with the balance of the seedlings being doubles. There were no triples or multiples.

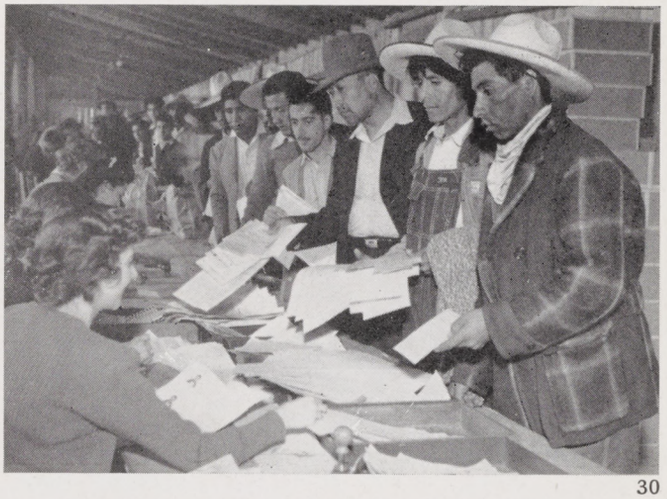
YIELD OF BEETS

Probably by this time you have asked yourself about yield. What is being done to increase yield other than through control of disease and bolting? A program designed to utilize hybrid vigor is under way. The method of breeding being followed is very similar to that worked out by corn breeders, who have revolutionized corn production by the development of hybrids. The program with sugar beets is in its infancy but the results to date are very promising.

THIS ISSUE

The material for this issue of the Spreckels Sugar Beet Bulletin was assembled and edited by Henry Sevier, General Labor Supervisor.

NEXT STATION — CALIFORNIA!



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Mexican Nationals receive their papers in the last step of the recruiting process in Mexico City.

The Spreckels Sugar Company has always assisted growers in securing needed **FARM LABOR.** This policy was carried on through the war years in the face of greatly increased difficulties. The Company was largely instrumental in the inauguration of the Mexican National program and, beginning with the 1942 harvest, has secured for its growers over 7,500 Nationals and several hundred Prisoners of War. For the 1946 season a total of 1800 Nationals and 600 Prisoners of War were requested.

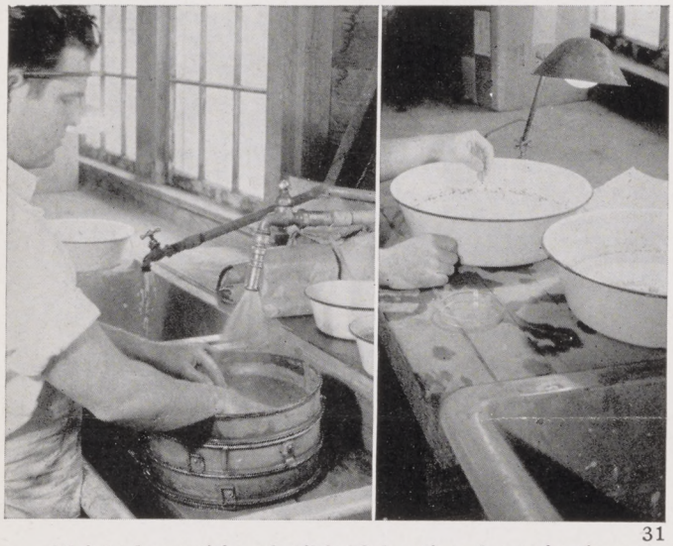
The Company maintains, as part of its agricultural staff, a group of men, whose duty it is to arrange for and distribute this labor. There is a Labor Supervisor in the Sacramento district and another in Salinas. In addition, there is a General Labor Supervisor. These men devote full time to labor matters.

Since it is necessary to contract for this labor far in advance of the time of actual need, the Company assumes this responsibility, and adjusts delivery schedules to meet changing requirements as to the number of men needed and the date of delivery. It is sometimes very difficult to coordinate these requirements with the amount of labor available due to changes in the transportation schedules of the Office of Labor.

All payrolls of Mexican Nationals assigned to the Company must be thoroughly checked by the District Offices for accuracy of computation and to see that needed information is correctly given. In addition, a complete personal record of each worker must be kept. This requires a considerable clerical staff, which does a great deal of work which would otherwise fall to the Grower. Since, in taking this responsibility the Company makes all the guarantees called for by the Contract with the Mexican Government and is responsible for full compliance with the terms of the contract with the Office of Labor, these records must be kept.

The Company is proud of its record in the labor field and assumes these tasks, feeling that in so doing it is rendering a worthwhile service to the grower.

ANALYZING FOR SCLEROTIUM



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Weighed quantities of soil for Sclerotium determination are first washed through a series of screens, then the sclerotia are removed, counted, and germinated to determine the percentage that are viable.

Prevention of financial loss to the grower through **PREDICTION OF SCLEROTIUM ROT DAMAGE** is a definite service to the Spreckels grower whose fields may be infested with this fungus. The method of making these predictions was worked out by Dr. L. D. Leach of the College of Agriculture, and has resulted in great savings to many growers.

Prior to planting of fields in which the presence of Sclerotium is known or suspected, tests are made in the following manner:

(1) Soil samples are taken at uniform intervals over the field with a soil tube or trowel.

(2) These samples are washed over a series of screens to recover Sclerotia, or "seeds."

(3) The "seeds" are placed in a germinator to determine viability.

From the laboratory data obtained as above, the population of viable Sclerotia in the field is calculated, and this population indicates the probable damage to a beet crop. If the indicated loss is not great the grower is advised to plant beets and to use a nitrogenous fertilizer to aid in reducing damage. When the probable loss is high the Field Superintendent suggests that the field not be planted to beets until such time as the population is reduced by means of a crop rotation utilizing non-susceptible crops.

The **CONTROL OF THE BEET LEAF HOPPER** *(Eutettix tenellus,* Baker) is an important service to the beet grower. Prior to 1931 there were serious outbreaks of this insect at more or less regular intervals. In the years 1919 and 1925 the damage to the beet crop in northern California was over 50 per cent. Since 1931, when control of the leaf hopper was started, a very small amount of damage has been sustained by affected crops grown in the Sacramento Valley, the Delta, and the coastal valleys. Some amount of protection was afforded to the San Joaquin Valley crops. Resistant varieties of sugar beets have been developed and improved since 1937, so that, at the present time, the combination of control, resistant varieties, and time of planting, has been sufficient to make possible successful sugar beet growing in the San Joaquin Valley.

The damage that is caused by the beet leaf hopper is due to the injection of a virus into the sugar beet in the process of feeding and the resulting disease is known as "curly top." Other crops such as tomatoes, flax, spinach, swiss chard, honey dew melons, white beans, and other lesser crops are affected. Most of these crops, especially tomatoes, have benefited materially from the leaf hopper control work.

Because of the nature of the disease and the habits of the insect, spraying in the beet field has generally been impractical. For this reason an annual spraying project has been carried out in the west San Joaquin Valley where great numbers of beet leaf hoppers overwinter. Russian thistle, the chief host plant of these insects, abounds in this territory and a companion campaign is being waged for its eradication. This campaign has reduced the amount of spraying necessary to one-third in the twelve years of control measures covering the area from the Altamont Pass to the Kettleman foothills. Work has recently been extended to Kern County with good results.

BEET LEAFHOPPER SPRAY EQUIPMENT

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This spray outfit is used to destroy beet leaf hoppers before they migrate from winter quarters to the sugar beet fields.

RESEARCH is vital in any industry and is a continuing, never-ending project. Spreckels Sugar Company for many years has undertaken, through research, to find ways of decreasing costs of sugar beet production and increasing ing yields. Some of this research has been conducted within the Spreckels agricultural organization and some through industry-wide and governmental research organizations by contributing financially to these groups.

The results of the many research projects have been reported over the past several years to growers through the Beet Bulletin, and the men on the agricultural staff have been kept currently informed as to the progress and results of this work so that at the earliest possible time they could pass along to growers suggestions which might be useful in improving beet production. It is of interest here to review briefly some of the major research projects which have been undertaken or are now under way.

The development of varieties resistant to the virus causing the disease, **Curly Top,** was started by the Company two decades ago. At that time selections of strains resistant to Curly Top were started and the material was later turned over to the Bureau of Plant Industry of the United States Department of Agriculture.

We should like to give credit here to the United States Department of Agriculture (Bureau of Plant Industry) for its outstanding achievement in the development of Curly Top resistance. Through the many years that the Curly Top resistance breeding program has been under way the Company, through financial assistance and advice, has aided in every way possible in the acceleration and consummation of the various stages of this breeding program. The improvement of varieties is, of course, a project which requires constant effort.

To augment the work of the government in variety improvement and to improve beet varieties for local adaptation, the Company has on its own staff a trained geneticist, who is vigorously attacking this problem.

The maintenance of adequate quantities of nutrients in the soil for maximum plant growth has always been a problem of utmost importance. Extensive **fertilizer tests** have been and are being conducted in various areas of the state in which commercial fertilizers of various types have been used, including the micro-elements, and also organic fertilizers, such as manures and cover crops.

Maintaining proper moisture supply in the soil is another important factor in beet production and the intensive program carried on by the company to determine the most practical methods of measuring soil moisture in commercial field operations, the regulation of irrigation practice based on **soil moisture data** can all be recalled by growers who were producing beets prior to the war. This program was necessarily discontinued during the war period, but because of the extreme importance of soil moisture in obtaining maximum yields and reducing costs, this project will again be undertaken as soon as it is practical to do so.

Studies have been undertaken to determine the interrelationship and influence of fertility, moisture, soil aeration and population on yields, which information is basic to an understanding of the problems of fertility and soil management.

Research in the **mechanization of beet production** has been of considerable importance and the Company has contributed heavily in both time and money, first through contributions to the University of California and the Colorado Agricultural Experiment Station and more lately through the nation-wide research organization set up by the beet sugar processors of this country, known as the Beet Sugar Development Foundation. This Foundation is not only undertaking to advance beet sugar mechanization by a program within its own organization and by assigning various problems to the different beet sugar companies, but is also contributing funds to state and federal organizations to assist them in undertaking basic but practical projects, the results of which should provide the answers to these problems.

Contributions of the Company to the **Division of Plant Nutrition** of the University of California have aided in the securing of much basic information on the nutritional requirements of sugar beets. The University has been aided through other contributions in which the Company participated with other California beet processors with the object of obtaining information on **Sclerotium rolfsii** and the control of this disease.

A careful study has been made of the growth of the sugar beet plant and data obtained are a helpful guide to the grower in determining the proper time to apply irrigation water and fertilizer in order to obtain best results.

Planter improvement, seed treatment to control seedling disease, mechanical blocking of beets, weed control, methods of controlling or reducing the hazards of crust formation, the adaptation of bed planting for sugar beets, preparation of seed through shearing, grading and cleaning and the better utilization of beet by-products are some of the other problems which have been the object of research.

MODERN BEET LOADING STATION

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This low-ramp, high capacity beet dump has a 26-foot, 18-ton capacity hopper and 7-foot Rienks screen. This particular station is located in Hollister and was installed in 1945, as were two similar stations in the Bakersfield District. The capacity of this type of dump is 600 tons per hour. It is powered by three electric motors of 20, 15 and 7½ horsepower, respectively. The car puller is ingeniously located below the frame so that cars may be moved in either direction. An electronic voice communicating system connects the scale house and dirt tare house.

Many kinds of fertilizers are applied in various quantities throughout the beet growing areas of California. To determine the extent to which the nutrient requirements of sugar beets are being met, the Spreckels Sugar Company in cooperation with the University of California, conducted a **PLANT NUTRIENT SURVEY** over a four year period.

This plant nutrient survey was based upon the premise that the nutrients found in the plant at any one time reflected the ability of the soil to supply those nutrients. Through plant analysis it can be found that either the plant has a sufficient supply of nitrogen, phosphorus and potassium or that the supply is inadequate. Therefore, if the supply of any one nutrient is inadequate, it follows that additions of the needed nutrient probably would increase the growth of the plant providing some other factor was not preventing such growth.

In making the plant nutrient survey various fields within each Spreckels Sugar Company district were selected for the tests. Each field was divided into four approximately equal parts. Periodic samples were collected taking one leaf at a time at uniform intervals from thirty to forty locations across the center of each part of the field. The leaf selected for sampling was the most recently matured leaf located midway between the center and the outer cluster of leaves. After selection, the leaf blade was discarded and the petiole or leaf stalk was retained and placed in a paper bag. These were then sent to the Division of Plant Nutrition of the University of California for analysis.

The result of this analysis gives a clue to deficiencies of the nutrients mentioned and forms a guide to fertilizer application.

SEED PREPARATION, by the Spreckels Sugar Company, is governed by a definite company policy, with the primary object of furnishing growers sugar beet seed of the highest possible quality. Preparing seed consists of various operations, all of which can contribute toward high quality seed.

Warehousing—Proper maintenance of seed lots and varieties in good storage buildings.

Cleaning—Screening, recleaning, and using an aspirator for removal of non-viable seed units, in order that high seed standards will be met in all seed lots.

Shearing—Breaking down the seed units to secure more uniform sized seed and a greater amount of singleness per seed unit.

Grading—Sizing of seed into a uniform product to bring about better planter performance.

Packaging and Labeling—Packing of sheared and graded seed into a sack of convenient size. Proper labeling of all beet seed with the variety and lot number prior to issuing.

Germination—Conducting current germination tests on all seed lots, in order to maintain an accurate record of the seeds' viability.

Seed Treatment—Maintaining in the seed warehouse a supply of seed treating material of the latest type to be issued with seed, for the growers' convenience.

Returned Seed—All unused seed returned by growers is carefully recleaned and checked before reissue.

Seed preparation along with all other phases of producing and handling seed must be done with the utmost caution and accuracy, because of its vital importance toward obtaining maximum yields.

SEED DELIVERY

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Carefully prepared and cleaned Spreckels sheared seed, packed in 50-lb. bags, on its way to the grower.
(Photograph courtesy E. M. Hartmann)

When it became difficult, and later impossible, to secure beet seed from Europe, the Company was able to supply **HIGH QUALITY SUGAR BEET SEED** to its growers through its association with the West Coast Beet Seed Company. This organization grows seed in Washington, Oregon, and California in localities where the best results are obtained.

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High yielding beet seed field in southern Oregon nearly ready for harvest. Foundation stock for the Spreckels Sugar Beet Breeding Project was selected from southern Oregon beet seed fields such as this.

This seed company was sponsored by forward-looking western beet sugar processors in order that seed supplies of improved varieties developed in this country could be obtained and to become independent of foreign-grown seed. Without such a source of seed, there would have been very few sugar beets produced in the United States during the war years.

The product of the West Coast Beet Seed Company, coupled with the advanced methods of seed preparation used by the Spreckels Sugar Company, insures growers the finest seed obtainable at the present time.

HONOR ROLL

ACREAGE CONTRACTED WITH THE SPRECKELS SUGAR COMPANY FROM WHICH YIELDS OF SUGAR BEETS WERE OBTAINED IN 1945 IN EXCESS OF 25 TONS PER ACRE

Contract	Tons Beets Per Acre	Pounds Sugar Per Acre
AVERAGE CALIFORNIA YIELD	16.4	
Arthur T. Himmah	39.19	13,990
Irvin Dethlefsen	38.28	10,933
Gabilan Packing Co.	37.37	11,265
J. G. Silveira	36.49	12,668
M. G. Da Rosa	35.27	10,906
Pasque & Franscioni	34.10	11,531
A. & V. Vosti	33.88	11,311
Earl Wilson Packing Co.	33.79	10,949
A. C. Madolora	33.14	10,341
Irvin Dethlefsen	32.89	11,414
Irvin Dethlefsen	32.52	10,061
Irvin Dethlefsen	32.45	9,812
Sears Bros. & Co.	32.28	11,557
Irvin Dethlefsen	32.13	9,324
James Bundgard	32.04	10,656
O. O. Eaton	31.12	9,710
Martin Capitanich	31.07	9,825
Felice & Sturla	31.05	9,687
Tony Homen, Jr.	30.52	10,958
William D. Crinklaw	30.29	9,656
F. Wimer	30.16	10,501
Margaret Ryan	30.00	9,318
James L. Kelly	29.78	11,138
Curly Top Resistance Breed Com.	29.77	10,330
Earl Wilson Packing Co.	29.73	10,288
Arnold Pura & Son	29.54	10,049
Tom Hudson, Jr.	29.46	10,103
Elmer J. Dethlefsen	29.46	10,100
R. Matteucci	29.46	9,597
F. R. Jewett	29.36	11,091
P. M. Resetar Co.	29.18	10,278
G. A. Stephens	29.04	8,590
J. Roy Smith	28.90	9,698
United Farms Co.	28.81	9,944
Silacci Bros.	28.79	11,108
Dora, James & Carl Rianda	28.67	9,617
Joe Montano	28.60	9,695
Lindeleaf Bros.	28.58	9,893
L. Verzascioni	28.44	10,114
Mary F. & E. E. Nutting	28.32	8,422
O. O. Eaton	28.28	10,062
Cecil Allen	28.17	10,388
E. D. Bedolla	28.06	10,000
F. D. Willoughby & Son	27.97	9,380
O. O. Eaton	27.83	8,461
Frank Tunzi	27.69	9,460
Mike Reed	27.67	9,935
John Dougherty	27.65	8,675
Frank E. King	27.64	9,746
George Martella	27.58	9,089
Joe Manzoni	27.48	10,184
Tavernetti Ranch	27.44	10,022
M. P. Domingos & M. P. Valine	27.44	8,967
John M. Silveria	27.40	10,045
R. A. Renz	27.39	10,233
T. H. Holthouse	27.38	8,855
Chas. Gianolini	27.33	9,859
Thos. B. Porter	27.32	10,172
Geo. S. De Lorimier	27.28	9,116
Hubert McGehee	27.27	9,848
Tom Storm	27.19	9,969
Lawrence Brickey	27.18	9,533
E. Vosti & Son	27.16	8,462
Albert L. Taix & Co.	27.08	10,341
Alva Clement & C. M. Thayer	26.92	9,652
Paul E. Bassi	26.91	9,704
Petersen Bros.	26.90	9,195
Anthony J. Garcia	26.88	10,554
A. Frew	26.85	9,945
Manuel Faihlo	26.80	8,061
Peterson Bros.	26.68	9,609
J. I. Victorino	26.68	9,280
Joe Manzoni	26.65	9,237
Martin Capitanich	26.58	8,730
Sears Bros. & Co.	26.53	10,189
T. G. Bacciarini	26.50	9,418
M. G. Da Rosa	26.46	9,165
Arthur T. Himmah	26.41	9,256
Manuel G. Dutra	26.33	10,060
H. P. Garin Co.	26.30	9,517
Charles Morgantini & Son	26.28	9,156
Henry Moranda	26.27	10,415
T. R. Merrill	26.23	9,227
Joe Jacinto	26.18	8,397
Lawrence Brickey	26.10	9,026
Petit Bros.	26.05	9,447
Chas. Morgantini & Son	26.03	9,183
Frank F. Minhoto	25.94	8,269
Albert L. Taix	25.90	9,470
John Schadeck	25.87	9,646
James M. Seaton	25.86	9,755
Emil C. Meyer	25.80	10,002
Farley Fruit Co.	25.78	9,048
Ben Kummerfeld	25.74	7,944
Ben Kummerfeld	25.66	9,575
Q. L. Gearhart	25.63	9,904
A. Montalbretti & H. Rolandi	25.56	9,001
H. T. Carlson	25.52	7,549
Oliver C. Bardin	25.40	9,835
O. O. Eaton	25.38	9,169
A. L. Reel	25.33	7,928
Frassetti Bros.	25.28	9,762
Peterson Bros.	25.25	8,975
E. M. Juhler	25.22	8,767
Garnet W. Herbert	25.21	9,092
J. M. Campbell	25.21	6,817
Henry Allemand	25.17	7,662
Luis Scattini	25.16	9,018
H. Amen	25.15	7,474
J. J. Strehle	25.13	7,232
Peter A. Stolich	25.10	8,017
J. G. Marinovich	25.10	7,898
W. J. Schween & Son	25.08	10,397
Martin & Loris Rossi	25.08	8,849
F. E. Warner	25.07	7,526
V. Vanoli	25.05	8,821
Manuel P. Baliel	25.03	8,715
Darsie & Beck	25.02	7,716
J. & A. Andersen	25.01	8,590

WEEDS INCREASE MECHANICAL HARVESTING COSTS

By WILLIAM REDDING, JR., *Agricultural Department, Spreckels Sugar Company*

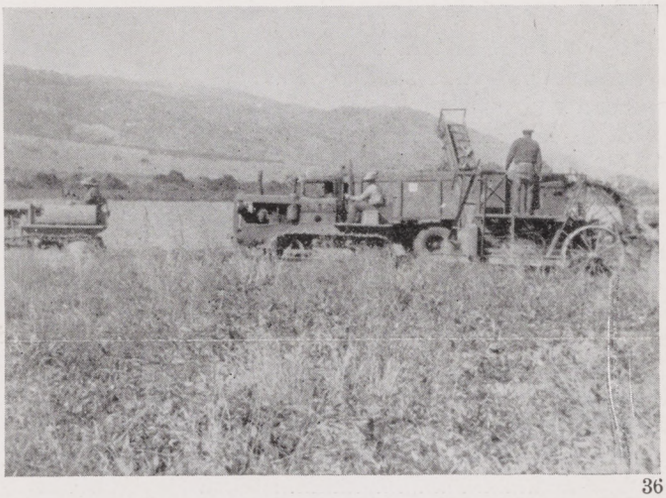
The removal of weeds prior to harvest of sugar beets is very essential, if growers plan to use Marbeet harvesters. Experience gained in 1944 and 1945 showed that fields heavily infested with weed growth were not as efficiently harvested as compared with fields free of weeds.

The principal weeds seriously affecting mechanical harvest are water grass and morning-glory, although others, such as wire grass, pigweed, etc., may slow down harvest progress materially. Water grass, despite being an annual weed and shallow-rooted, is firmly rooted and matted in the ground. As the beets are spiked by the Marbeet, harvested and lifted out of the ground, large masses of water grass roots with dirt adhering are likewise lifted out. In many cases these chunks of matted roots and dirt drop off the wheel, carrying the spiked beets with them. Truck loads from these fields are trashy in appearance and generally have a high tare weight.

Morning-glory is similar to water grass in affecting a mechanical harvest in which many beets are left behind and a poor topping job is done. Morning-glory tends to create more stoppages of the machine, as the vine may collect on the plows, rollers, and topping knives, thus considerably slowing down the progress of the machine.

Some attempts have been made to remove weed growth immediately prior to harvest. By mowing this weed growth and the beet tops two or three inches above the crown of the beet, growers have been able to harvest with the Marbeet machine with partial success.[1] However, it is difficult to accomplish an efficient job under these conditions and the removal of the weeds from the field after mowing proves costly.

With the advent of a less costly harvest by use of mechanical equipment, growers can better afford to place more emphasis on hoeing, cultivation, and other methods of eliminating weedy conditions in the sugar beet fields.



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In fields infested with water grass, harvest with the Marbeet harvester is difficult as the water grass is firmly rooted and matted in the ground. As the beets are spiked by the harvester and lifted out of the ground, large masses of water grass roots with dirt adhering are also lifted with the beets.

HARVEST VS. WEEDS

1. Weedy fields at harvest time discourages hand labor, increases cost, and decreases yields.
2. Many fields cannot be harvested with the Marbeet harvester if too weedy.
3. Weeds allowed to mature during the harvest period will reseed the ground for the following year.
4. Weedy fields are unsightly any time during the year.

SPRECKELS SUGAR BEET BULLETIN

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. X JULY-AUGUST 1946 No. 4

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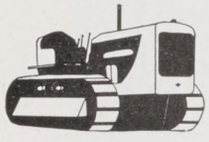
THE 1946 MECHANICAL HARVEST PICTURE

There are 25,000 dots in this picture. Each dot represents one acre of sugar beets to be harvested mechanically by Spreckels Growers in 1946.

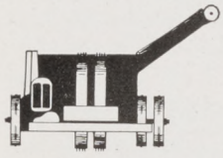
Harvesting 25,000 acres of sugar beets by machine is a big job. This job is by far the largest coordinated mechanical sugar beet harvest program ever undertaken. Growers for the Spreckels Sugar Company will not only attain this 25,000 acre minimum goal, but should far exceed it. They will do this job with Marbeet Harvesters, either owned by themselves or rented from the Company. They will supply their own tractors and operators. The Company will service all harvesters.

THE 1946 EQUIPMENT PICTURE



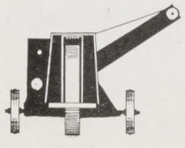
100 TRACTORS

(Supplied and manned by growers)



74 TWO ROW MARBEET HARVESTERS

(20 grower-owned, 54 Company-owned)



26 ONE ROW MARBEET HARVESTERS

(6 grower-owned, 20 Company-owned)

4 HEAVY SERVICE TRUCKS

(Supplied by the Company)

5 LIGHT SERVICE TRUCKS

(Supplied by the Company)

4 HARVESTER TOW TRUCKS

(Supplied by the Company)

THE MECHANICAL HARVEST PROGRAM FOR 1946

The mechanical harvest program briefed on the front page of this issue presents only the framework on which the complete program is built. Supported by this framework of equipment is the administrative structure comprising the scheduling of harvester and service vehicle movements, the Company's policy regarding rental, sales and service, and the vitally important cooperation of growers.

HARVESTER SCHEDULING

In order to complete the 25,000 acre mechanical harvest which will soon start, every Marbeet harvester must be in operation throughout the harvest season. This does not mean uninterrupted operation, since time is consumed in moving harvesters from district to district, and from grower to grower within each district. Some time is also required for mechanical service, although this has been minimized by the many functional improvements on the 1946 machines, and earlier machines which have been modernized.

The backbone of harvest scheduling is allocation of harvesters to growers. This allocation has been accomplished over a long period of time, and very nearly meets the requirements of all growers desiring mechanical harvest.

It must also be pointed out that growers have serious obligations to other growers insofar as they must complete harvest on schedule if succeeding users of their harvesters are not to be delayed.

RENTAL, SALES AND SERVICE POLICY

The Company's rental plan for 1946 is the same as for 1945 except for a reduction in the rental rate for one-row harvesters. The one-row Marbeet harvester rental will be $7.50 per acre. The two-row rental will remain at $10.00 per acre. (These figures are, of course, subject to future action of the O.P.A.) Rentals paid for the use of either harvester may be applied toward the purchase of that harvester. In the event of sale, any parts used in maintaining the harvester during the period in which the purchaser rented it will be charged as part of the purchase price. Maintenance labor, however, is not charged.

Routine service is provided by the Company for all harvesters, whether owned or rented by their users. No charge will be made for labor or use of the service vehicles. Parts and materials will be charged to growers owning their own harvesters, but not to those renting harvesters (except when the harvester is later purchased).

Service vehicles, well stocked with parts, will operate as closely as possible on scheduled runs, whereby two visits per week will be made by a service vehicle to each harvester. As a further safeguard against lost operating time, each harvester is provided with about a week's supply of expendable parts, such as sickle bars, plow shares, topping knives, etc. A covered steel box is a part of every harvester. Spare parts are stored in these boxes, protected from dirt and moisture.

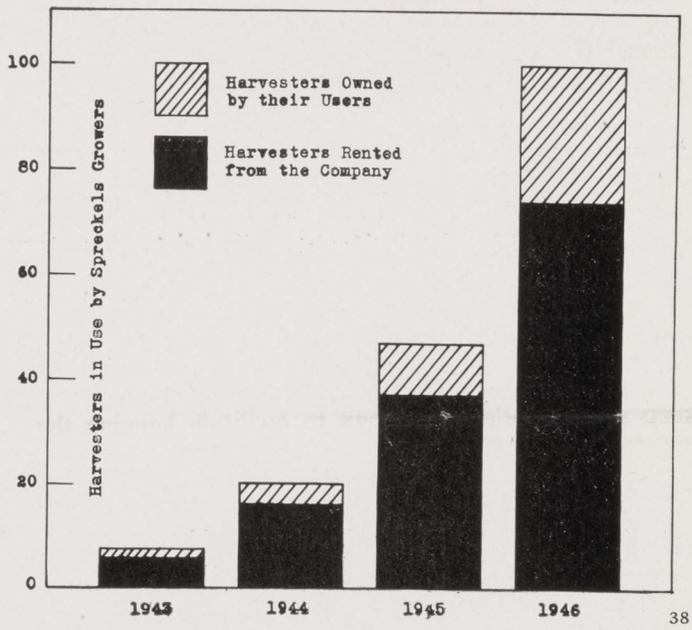
GROWER COOPERATION

The successful execution of the foregoing plan is dependent on the extent of grower cooperation. The Company bases its minimum quota of 25,000 acres of mechanical harvest on demonstrated grower cooperation and known equipment facilities. But the acreage in excess of 25,000 will be contributed in increased effort by growers.

This effort, in general, is defined by the degree of utilization of available equipment. Contributing to a high degree of utilization are the ideas presented in this issue, entitled "Suggestions for Increasing Harvester Efficiency." Harvester users are urged to read this article—it contains valuable material.

GROWER OWNERSHIP OF HARVESTERS IS INCREASING

The rapid growth of confidence in mechanical harvest is demonstrated by the chart below, which graphically reveals the increase in Marbeet harvesters owned by growers producing beets for the Spreckels Sugar Company. Since the introduction of mechanical harvest in 1943, the number of grower-owned machines increased more than tenfold, and growers now own 26 per cent of all harvesters operating in Spreckels Districts.



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THIS ISSUE

In keeping with the policy of assigning the assembling of material for each issue of the Spreckels Sugar Beet Bulletin to an individual member of the Agricultural Department staff, this issue was assigned to Austin Armer, Agricultural Engineer.

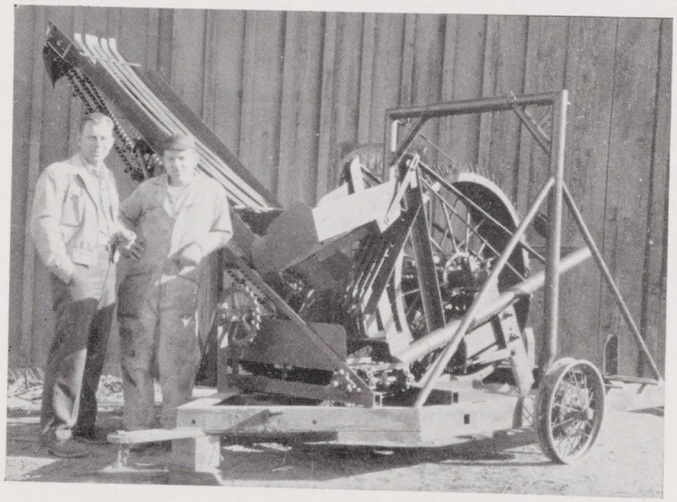
To Julian Williams goes special credit for his painstaking work in designing and drawing the plans for an improved beet truck bed.

AIDS TO OPERATING THE MARBEET JUNIOR HARVESTER

By LEWIS SCHMIDT, *Engineer*
The Blackwelder Manufacturing Company

This article will deal with those items which, during field operation, will aid in obtaining the maximum results from the Marbeet Junior harvester.

One of the most important factors governing the success of any type of mechanical harvesting is the planting and growing of the crops with a view toward mechanical harvesting. Herewith are some factors, controllable during this period, which will contribute greatly to a successful harvest.



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Lewis Schmidt (right) and his brother, Lloyd Schmidt, are co-inventors of the Marbeet harvester. Shown here is their original model, forerunner of the hundreds of Marbeet harvesters now in commercial use.

First consideration should be the choice of row spacing to fit the equipment to be used: tractor, planter, cultivator, etc.

Proper care in planning field layouts with ample headlands for turning trucks and machines will aid in rapid harvesting.

If beets are furrow irrigated, care should be taken to keep rows parallel to furrows to facilitate keeping the harvester on the row.

Care should be taken to see that beets are not covered with dirt during cultivation in the initial stages of growth as this will cause the crowns to grow under the surface of the ground, creating quite a problem in using the machine. This can be especially troublesome in bed planting.

Fields should be kept as free of weeds as possible.

Moisture, at harvest, sometimes can be controlled to an advantage. If the crop consists mainly of small beets, the percentage of recovery can be considerably increased by harvesting in fairly moist soil.

In hard or abrasive soils a small amount of moisture will facilitate plowing, lighten the draft of the machine, and decrease wear on the plows.

During harvest, bear in mind that the machine will only harvest beets while it is running. Careful field management to minimize lost operating time adds greatly to a rapid harvest.

The operator of the machine should take full advantage of any time the machine is stopped for lack of trucks or other reasons. By checking the machine and making any necessary adjustments, lubricating, cleaning, etc., he can do enough preventive maintenance to greatly help the machine operate with a minimum of trouble. Even the time used in deadheading at the end of each row can be used advantageously for cleaning the sickle and dirt filters. This is especially important when working in wet conditions.

Plows on the Marbeet Junior are different from those used on previous models. The plows, both front and rear, consist mainly of straight shanks with wings on the bottom. The lower sections of the plows are riveted to the standards and should be replaced when worn.

Set the plows according to instructions given in the Operator's Manual furnished by the manufacturer.

Plow adjustment longitudinally is not critical. However, the depth and width between the wings of the rear plows are very important.

The plow assembly is constructed so the plow standards may be bolted to the inside or outside of the upper plow supports. This controls the distance between the plow standards and the beets. In normal conditions the plows are usually set on the outside of the upper plow supports to give more steering tolerance. However, when working in wet conditions it will be found that moving the plow standards to the inside will materially decrease the amount of mud carried up by the spikes.

If the distance between the wings of the rear plows is too great, the tap roots of the beets will not be loosened and consequently beets will be left in the ground. This can also be caused by the rear plows not being set deep enough.

Set the front plows as shallow and as wide as conditions permit to prevent slippage of the pickup wheel. Slippage will cause the beets to be picked up slanted on the wheel, resulting in slanted topping of the beets. If breakage of beets is encountered, try setting the front plows slightly deeper.

In case of beets growing high out of the ground it is necessary to run the front plows quite deep and close to the beets.

In highly abrasive soils it is suggested that plows be changed at frequent intervals and not allowed to wear excessively. Worn plows will not function properly. If three sets are used this can easily be accomplished. If plows wear excessively they necessitate complete and costly rebuilding.

The sickle bar on the Marbeet Junior will wear as it operates in the dirt carried up on the pickup wheel with the beets. The bar should be replaced as soon as worn or dull.

It is necessary to keep the hold-down clips tight so the sickle sections are held snugly against the ledger plates. This is particularly important when working in wet or weedy conditions.

If the machine starts to jam with weeds or foliage, never run until the machine jams tightly. It will only take a short time to stop and clear the trouble but if allowed to continue it may take quite a while to clear.

If trouble is encountered keeping the machine on the row, partially deflating the tires will be of assistance.

The Marbeet Junior can work successfully without an operator on the harvester. However, in extreme weedy or rocky conditions, an operator is recommended.

Proper preventive maintenance will more than pay dividends in trouble-free operation. Be sure to study the information given in the Operator's Manual, and make certain that the machine operator is well acquainted with its contents. Above all, choose an operator with mechanical aptitude who takes real pride in his work.

SUGGESTIONS FOR INCREASING HARVESTER EFFICIENCY

By W. J. REDDING *and* C. W. PATRIE, *Machinery Specialists*
Spreckels Sugar Company

The efficient operation of Marbeet harvesters depends directly upon the observance of well defined operating rules. In addition to these rules, a number of special adjustments to meet unusual field conditions have been developed, and are published herewith following the presentation of the basic operating rules.

BASIC OPERATING RULES

1. The harvester operator must be capable.

The selection of an operator can spell success or failure of the entire harvest operation. A good operator need not have Marbeet experience—but he must be a man of genuine mechanical ability and must possess a true sense of responsibility. Such qualifications are found only in men having a background of experience in the operation and care of farm machinery.

2. The tractor must have adequate power and a skilled driver.

Tractor selection is so important that a complete article covering the subject has been included in this issue of the Sugar Beet Bulletin. The ability of the driver is of no less importance. A degree of real skill is required to keep a harvester accurately on the row, and the tractor driver must be chosen with as much care as the harvester operator.

3. Trucks must operate on schedule.

Failure of trucks to coordinate their hauls will result in idle time for both harvester and tractor. Complete elimination of this time loss can be accomplished only if there are enough trucks serving one harvester to replace a full truck with an empty as soon as loading is complete.

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Fig. 1.—This example of proper truck scheduling shows the empty truck following the loaded truck, ready to pull into place and start loading without stopping the harvester.

4. Harvester servicing should not interfere with operation.

Routine service requirements of both tractor and harvester (fueling, lubricating, adjustments, etc.) should be a task assigned to a particular member of the crew, with the understanding that these operations should be completed before the harvest day starts.

5. A weedy field is costly to harvest.

Elimination of weeds may be costly during the growing season. However, this expense is less than the loss of harvesting time, loss of beets, and cost of hauling trash during harvest. The Marbeet harvester can tolerate a fairly heavy weed growth, but only at considerable cost. (See figure 2.)

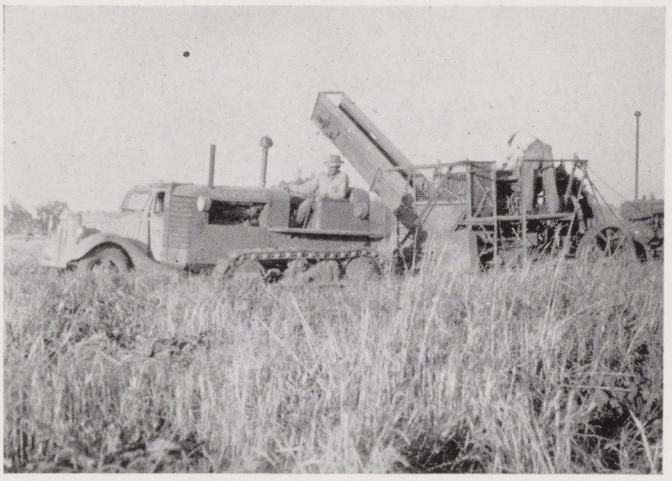

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Fig. 2.—Fields as weedy as this can be negotiated by the Marbeet harvester, but at greater expense than eliminating the weeds during the growing season.

6. Do not overload trucks.

Where hauls are short and trucks plentiful, there is economy in hauling partially loaded trucks. Large trucks on long hauls should be filled to capacity but not beyond. A capacity load usually calls for some hand-trimming of the beets in the bed. This can be done by the truck driver during turns in the field or in other odd moments, but is not economical if the harvester must remain idle.

By far the greatest loss in overloading trucks is the spilling of beets. In many cases most of the beets left in the field are those which roll off from overfilled trucks when machine operators attempt to get that last hundred pounds of beets into the load.

7. Do not wear plows beyond repair.

Plow shares and standards are hard-faced, and will operate from three acres to one hundred acres (depending on local soil conditions) before the hard-facing is penetrated. Because of this great range in soil characteristics, no schedule of replacement can be offered. The individual operator must pay close attention to plow wear and replace worn parts before they are beyond repair.

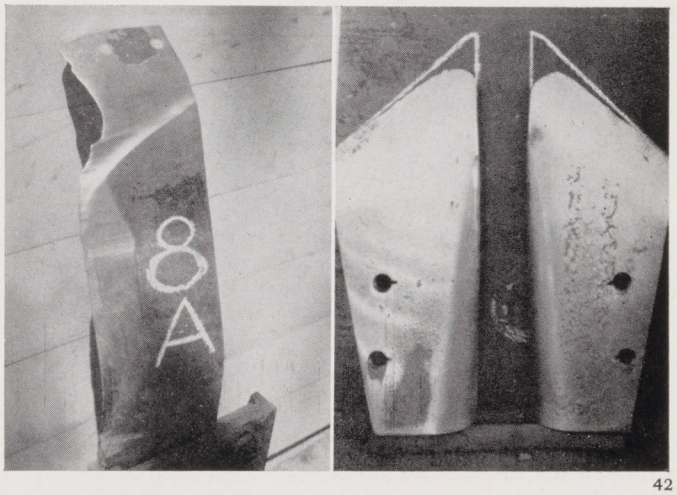

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Fig. 3.—The front plow (left) and plowshares (right) were worn beyond repair after only eight acres of operation in extremely abrasive soil. Close attention to plow wear can save much expense. By changing plows before the hard-facing has been penetrated, the worn parts can be salvaged at low cost.

SUGGESTIONS TO MEET SPECIAL CONDITIONS

Where soil is hard or abrasive, schedule the last irrigation to precede harvest by just enough time to leave the soil mellow but not muddy.

* * *

If harvesting must be done when soil and tops are excessively wet, remove alternate topping knives and remove rear side plows. Replace the front side plows with the rear plows, omitting the shares.

* * *

Where beets are small, use spacers behind the side plows to reduce the plow throat. This will loosen the beets and reduce draft.

* * *

Where water grass is severe, operate without the forward plows. This will prevent plugging, but will cause high-crowned beets to be broken.

* * *

Where beets are exceptionally high-crowned, breakage can be reduced by setting the forward plows well ahead, and deeper than the rear plows.

* * *

Never set the rear plows too deep. If beets are left in the ground, raising the plows will do more good than lowering them.

* * *

Where heavy or wet tops plug the sickle, use six hold-down clips on the sickle bar.

THE TRUCK IN MECHANICAL HARVEST

By J. P. WILLIAMS, *Civil Engineer*
Spreckels Sugar Company

In the mechanical harvesting of sugar beets there is such a direct interdependence between the harvester and the delivery truck that, for practical purposes, the two functions must be regarded as one.

Harvesting with hand labor permits some flexibility of truck operations, while with machine harvest no such tolerance exists unless the number of trucks in service is greater than the actual need.

The latter condition, within reason, is desirable since an idle harvester is considerably more expensive than an idle truck. Perhaps a near ideal arrangement is to have three trucks in service when the exact requirement is two and one-half. This gives assurance of an empty truck on hand ready to move into loading position as the previous load pulls away. It also provides a cushion which will largely absorb minor delays due to flat tires and other causes of like duration.

A minimum of two trucks is always required and in most cases more, depending normally on:

1. Yield of crop.
2. Tractor speed.
3. Length of haul.
4. Capacity of the truck and bed.

Our objective is the proper harvesting of beets at the lowest possible cost per ton and to make its full contribution to low cost operation, the truck must be properly equipped. In the final analysis its capacity is necessarily figured in terms of net accomplishment and a number of factors other than actual size are therefore involved.

These factors, and recommendations for dealing with them, are as follows:

MECHANICAL CONDITION

Have the truck in good working order, with good tires.

DRIVER

Get the best you can find. He must be capable in handling the truck and making minor repairs. The harvester starts and stops almost instantly and the truck driver must be alert to do the same. Make him responsible for the placing of the greater part of his load. He can do this by glancing back through the cab window or standing occasionally on the running board. A careful and dependable driver will avoid accidents and will be back to the field on time.

BEET BED

1. Make all necessary repairs before harvest starts.
2. Beds should be of uniform size or capacity, since the small truck may be loaded and gone before a larger one can return. This throws the whole operation off balance and lost time results.
3. The bed capacity should be great enough to take the desired weight of load without crowding. The latter may be justified to some extent on very long hauls, but beets are usually spilled overboard in attempting to round off a load to the limit. More are lost due to truck sway while getting out of the field and turning corners.
4. Modification for harvester service. Use of the truck with the harvester makes very advisable the elimination from the left side of any projections which may collide with the elevator. These projections are usually door hinges or latches located at the corners of the bed. In spite of all reasonable care, if the harvester stops unexpectedly while the truck is in close, particularly when the back end is being loaded, a badly damaged bed or elevator and a costly delay are likely to result.

As owner of a large majority of the harvesters to be in service on a rental basis this season, the Spreckels Sugar Company is interested in the best possible harvest performance, not only to protect its very considerable investment, but also to make available to as many growers as possible the supply of harvesters, which are in great demand due to their rapidly increasing popularity.

The final objective of grower ownership is also rapidly being realized and we believe that the suggestions offered above are of still greater significance to the growers who assume the additional responsibility of ownership.

On the accompanying pages are reproduced drawings covering in a general way a beet bed design which will give many years of service if properly built and cared for.

There are few definitely fixed rules governing such a design and the subject is always open to individual resourcefulness and ingenuity in effecting further improvements and in the use of substitute materials, when those desired are unobtainable.

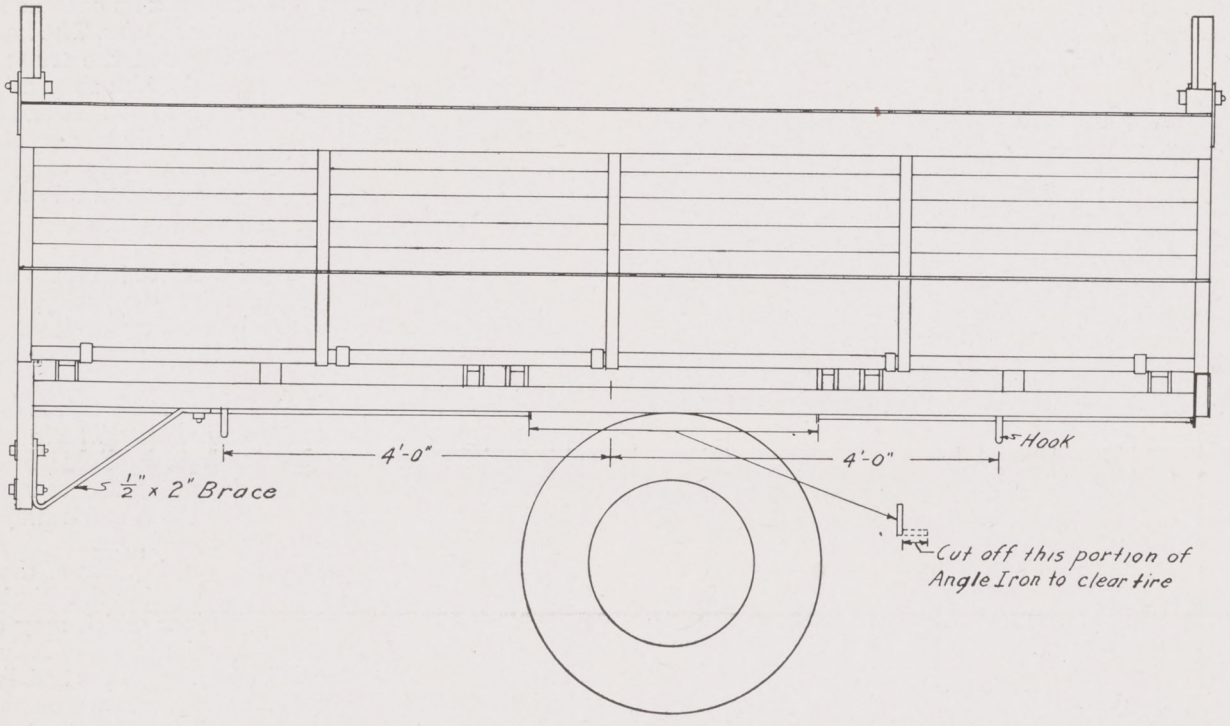
In most respects, the plans show nothing new or unproven and we have tried, rather, to include various good features which have been observed on existing beds.

It will be noted that this design permits dumping either right or left at any time, and this is urged in all cases where delivery will, or may be, made to right and left hand dumps. However, many growers are so situated that delivery to more than one receiving station need not be considered and the cost of the bed may, therefore, be lowered by eliminating this provision.

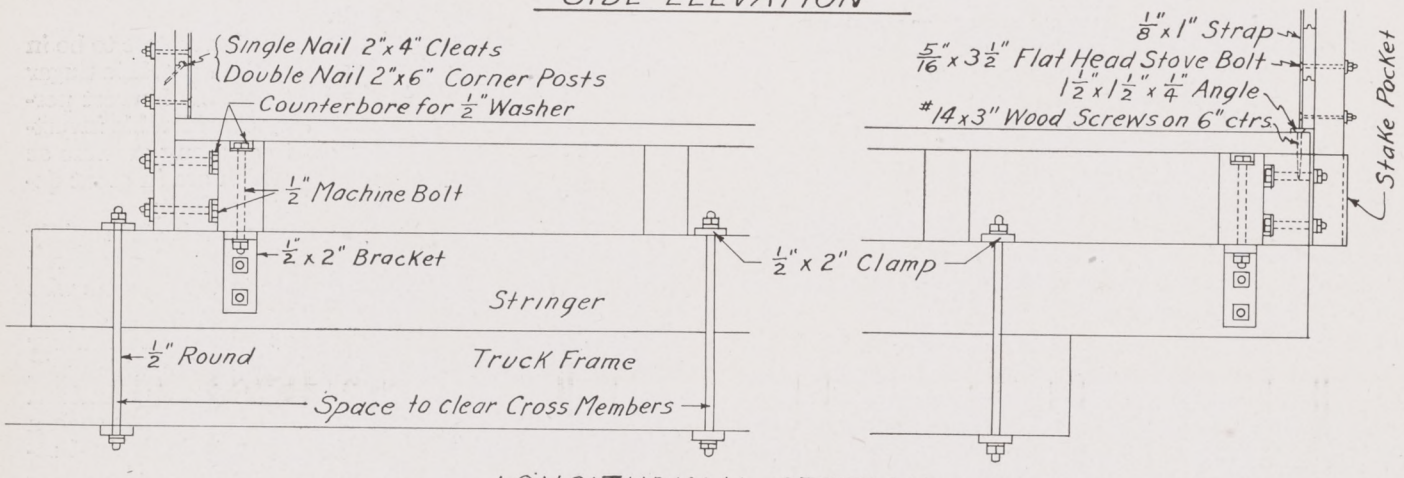
The method of hinging the door has not, to our knowledge, been tried previously and must be considered as experimental. It has the advantage of eliminating undesirable projections previously mentioned.

If the grower does not have all necessary facilities of his own, we believe it good business to turn the job over to a reliable and well equipped builder with previous experience in this type of construction.

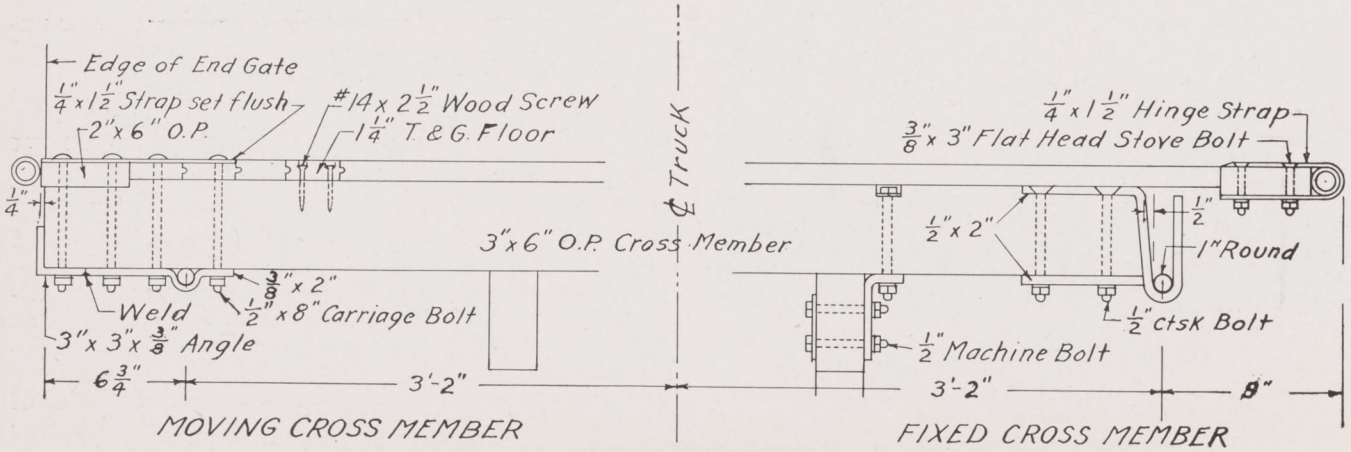
DESIGN FOR BEET TRUCK BED



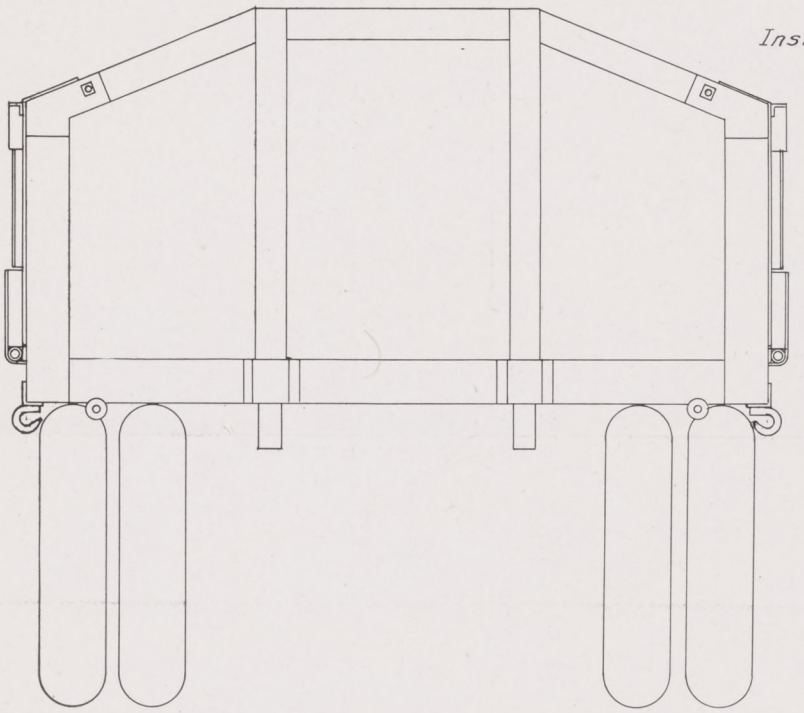
SIDE ELEVATION



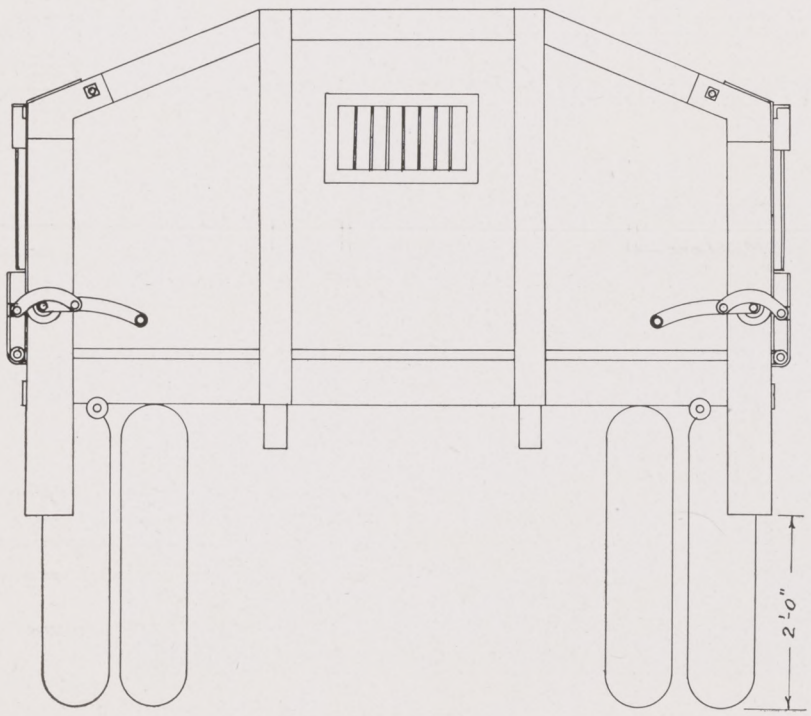
LONGITUDINAL SECTION



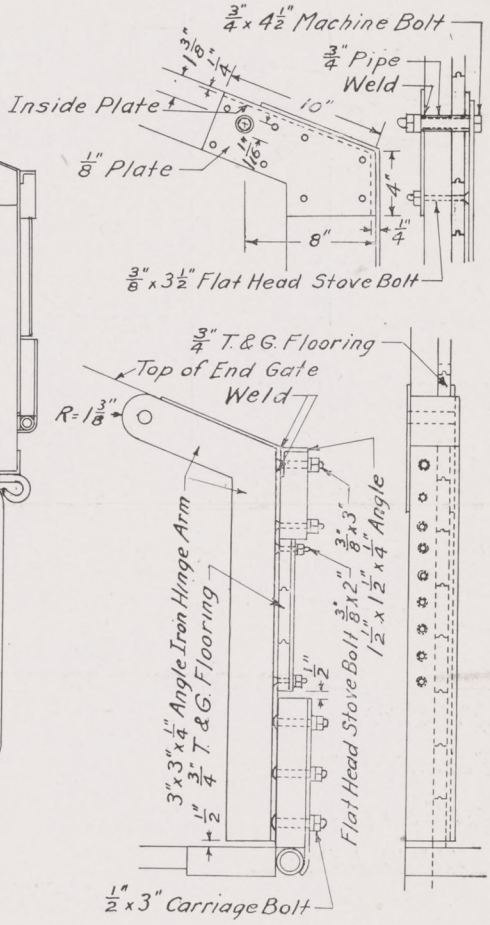
CROSS SECTION

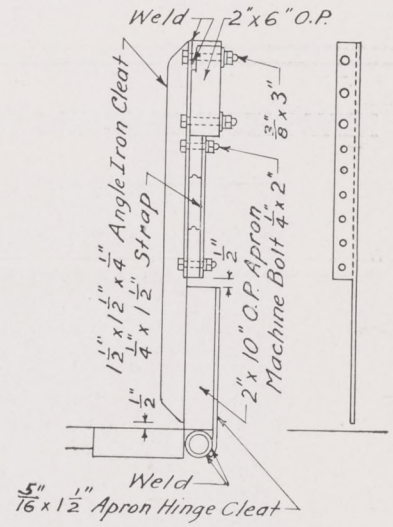


REAR ELEVATION

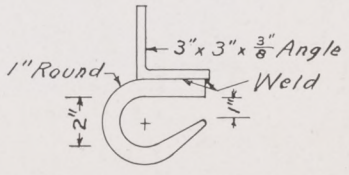


FRONT ELEVATION



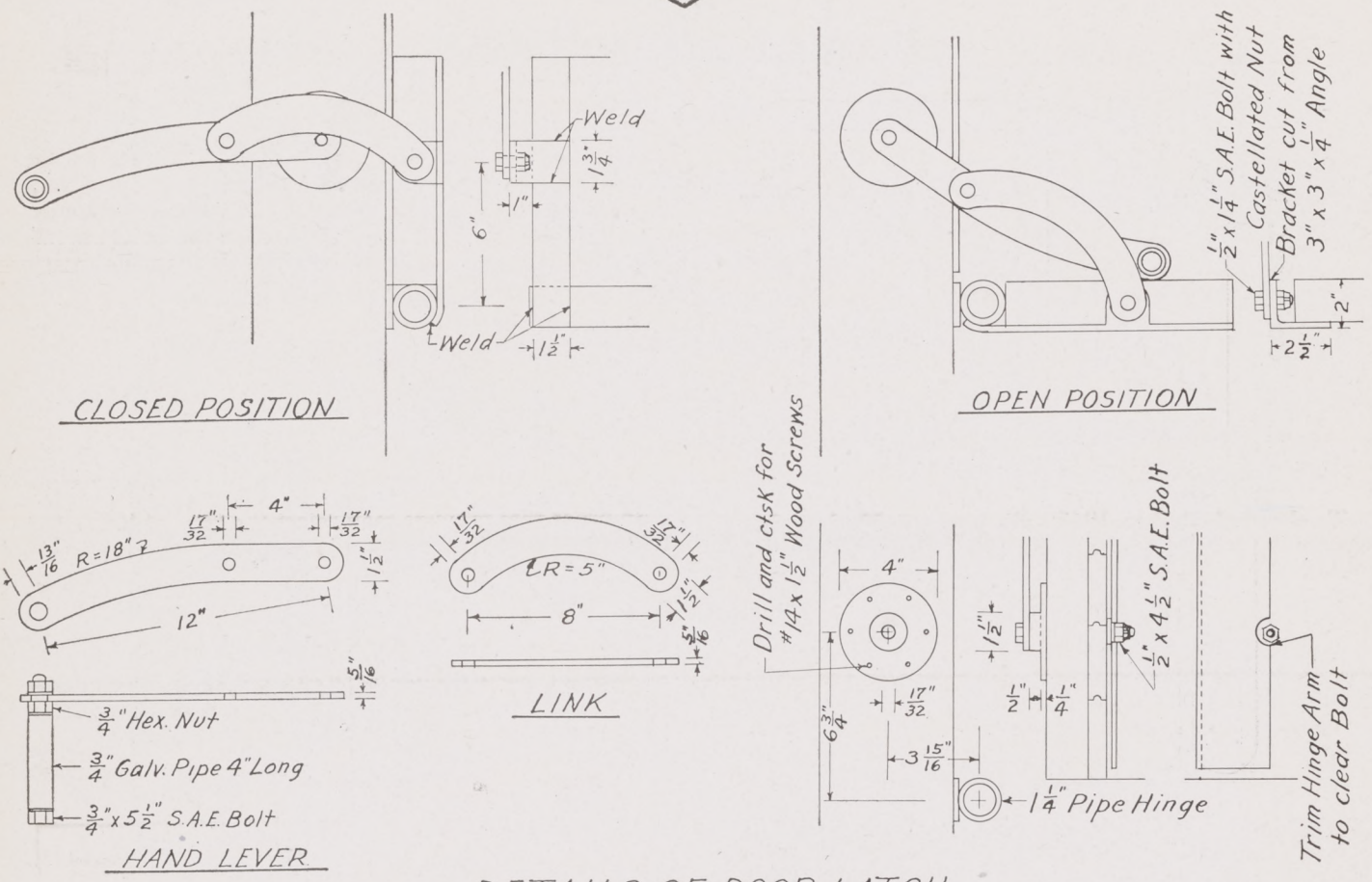


DETAILS OF DOOR



HOOK

SEE NEXT PAGE FOR DETAILS OF DOOR LATCH



DETAILS OF DOOR LATCH

Scale - 1 1/2 in. = 1 ft.

NEW DIESEL ELECTRIC SWITCHING LOCOMOTIVE FOR SPRECKELS FACTORY

43

This modern 65-ton 400 h.p. Diesel electric industrial switching locomotive was recently purchased from the General Electric Company by the Spreckels Sugar Company.

Diesel electrics are ready for operation 24 hours a day. Like the automobile, it starts at the push of a button. The acquisition of this unit will play an important part in efficiently handling the large 1946 crop of sugar beets.

TOP RECOVERY FROM MECHANICALLY HARVESTED BEET FIELDS

The present acute shortage of feed for beef and dairy cattle emphasizes the importance of recovering beet tops during harvest. Growers can ill afford to overlook this important feed source. Even though they may not have their own feeding programs, properly cured beet tops are in such demand by feeders and dairymen as to provide a ready market.

A reminder of the feed value of cured beet tops is in order. Various authorities report that a ton of cured beet tops is the nutritive equivalent of a ton of alfalfa hay.

Heretofore, Marbeet harvesters have discharged to the ground beet tops which are more or less mixed with soil and clods. Trucks following the harvester ran over one-half or more of the tops.

Trials conducted in 1945 with two-row Marbeet harvesters equipped with top deflectors showed that windrows, containing the tops from four beet rows, could be laid on the ground. These windrows could be straddled by trucks, and practically no tops were run over.

The 1946 Marbeet Junior harvesters have, as optional equipment, a windrowing attachment which deposits clean tops from three beet rows into a windrow.

These devices are not fully automatic. Deflector chutes must be adjusted after each round, and some attention must be paid to avoid plugging by bolters or large weeds.

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The Marbeet Junior, with top-windrowing attachment. Top windrows are properly shaped and spaced to permit straddling by the truck and negligible damage to tops.

Surely this is a small price to pay for neat windrows of tops, and the windrow is the basis of any subsequent top utilization.

For pasturing in the field, undamaged windrows are ideal. The stock tramples fewer tops than is the case with hand topped beets, and more completely consumes the tops.

But maximum utilization of tops and land is accomplished only if the tops are removed to a central feed yard. Windrows of tops can be loaded into trucks with a hay loader of the double-cylinder type equipped with close spaced draper ropes. (The raker-bar type of hay loader will not successfully pick up windrowed tops.) Loading can be accelerated and some dirt eliminated if two or three windrows are side-delivery raked into a large windrow. Both raking and loading should be done a day or two after harvesting to permit partial curing of tops.

FIT THE TRACTOR TO THE HARVESTER

By AUSTIN ARMER, *Agricultural Engineer*
Spreckels Sugar Company

The importance of adequate tractor power as a factor in obtaining good performance from Marbeet harvesters was demonstrated during the 1945 harvest. The influence of tractor power on acreage harvested is shown in the following tabulation (reprinted from the January-February issue of Spreckels Sugar Beet Bulletin):

Drawbar Horsepower	Average Weekly Acreage
45-50	20-27
55-60	33-35
70-85	35-40

These figures apply to the two-row Marbeet harvester.

In order that growers may select the type of harvester best suited to their tractors, a guide to harvester and tractor selection has been worked out in tabular form and is published herewith.

SIDE DRAFT SHOULD BE AVOIDED

The need for adequate tractor power having been demonstrated, the importance of applying this power equally through the two tractor tracks must be stressed.

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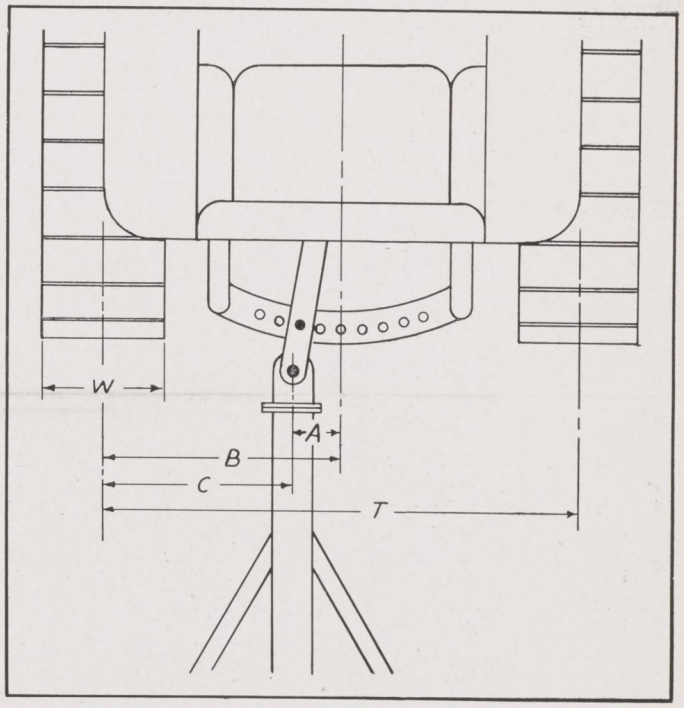

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This diagram illustrates the basic relationship between harvester and tractor dimensions.

T is the tractor tread (should be at least 10 inches less than row spacing).

W is the track plate width.

A is the offset of the tractor drawbar.

B is one-half the tractor tread.

C is the distance from harvester centerline to centerline of the left track.

A/B × 100 = % side-draft (never to exceed 50%).

C = 1½ × Row spacing for one-row harvester.

C = 1½ × Bed spacing (or 3 × row spacing) for two-row harvester.

FIT THE TRACTOR TO THE HARVESTER

(continued from page 33)

The tractor hitch may be offset up to a certain point without noticeably affecting steering or tractive effort. Any increase over this critical value of offset causes the front of the tracks to skid sideways, and constant fighting of the friction clutches results. Furthermore, when one track is momentarily disengaged for steering, the other track assumes full load and starts to slip. This in effect reduces the drawbar pull of the tractor.

Most tractors will tolerate a hitch offset equal to 20 per cent of one-half the tread width. Thus a tractor with a 60-inch tread can tolerate a 6-inch drawbar offset without noticeable difficulty in steering or loss of drawbar pull.

Only in rare cases is it possible to avoid side draft entirely. Since some side draft is encountered in the majority of tractor-harvester combinations, a guide to tractor selection has been worked out with a view toward reducing side draft to a minimum.

OFFSETTING THE HARVESTER HITCH IS NOT RECOMMENDED

Several users of two-row Marbeet harvesters in 1945 devised hitch offsets on the harvester tongues in the hope that the tractor drawbar could be pinned in the center position and avoid all side draft. While it is true that side draft is eliminated, the harvester does not trail properly, but "crabs" down the row. Where furrows in ridge-planted beets are quite deep, this "crabbing" is somewhat relieved, but severe strains are set up in the ground wheels and their bearings.

There is, therefore, only one correct combination of tractor and harvester that will give adequate drawbar pull, minimum side draft, and maximum harvester output. The choice of this combination can be made from the tables which follow.

GUIDE TO MARBEET HARVESTER AND TRACTOR SELECTION

Tractor Make	Model	Rated H.P. (Drawbar)	Speeds (M.P.H.) 1st	2nd	3rd	4th	5th	6th	Tread (Inches)	Marbeet Accommodated	Soil Type Accommodated
Allis-Chalmers	HD 7	60.1	1.84	2.55	3.45	5.82			63	2 Row	Heavy
	HD 10	86.6	1.69	2.06	2.68	3.78	4.62	6.03	74	2 Row	Heavy
Caterpillar	D2	26	1.7	2.5	3.0	3.6	5.1		42	1 Row	Medium
	D4	36	1.7	2.4	3.0	3.7	5.4		42	1 Row	Heavy
	RD6 (3 Cyl.)	45	1.7	2.5	3.2	4.6			56	1 & 2 Row	H & M
	D6 (6 Cyl.)	55	1.4	2.3	3.2	4.4	5.8		56 or 74	2 Row	Heavy
	D7	85	1.4	2.2	3.2	4.6	6.0		74	2 Row	Heavy
Cletrac	A Diesel	30	1.79	2.62	3.74				42 or 50	1 Row	Medium
	B "	38	1.81	2.64	3.46	5.4			44 or 52	1 Row	Heavy
	D "	61	1.7	2.3	3.1	4.9			48 or 61	2 Row	Heavy
International	T35 Diesel	38.0	1.7	2.2	2.7	3.2	4.0		45 or 56	1 Row	Heavy
	T40 "	49.5	1.7	2.2	2.8	3.2	4.0		48 or 60	1 & 2 Row	H & L
	TD6 "	29.5	1.5	2.2	3.1	3.8	5.4		40 or 50	1 Row	Heavy
	TD9 "	38.9	1.5	2.2	3.2	3.9	5.3		44 or 60	1 Row	Heavy
	TD14 "	55.0	1.5	2.1	2.5	3.4	4.8	5.8	56 or 74	2 Row	Heavy
	TD18 "	74.2	1.5	2.0	2.5	3.3	4.6	5.7	74	2 Row	Heavy

PREFERRED TREAD AND TRACK PLATE WIDTH FOR VARIOUS ROW SPACINGS

Row Spacing	Harvester Best Suited	Tread Width 1st Choice	% Side Draft	2nd Choice	% Side Draft	Maximum Track Width
20-20 or 18-22	1 Row or 2 Row	56"-63" 40" or 74"	0-5 0-8	40"-45" 56"-63"	50-55 64-68	10" 10"
14-26 or 16-24	2 Row only	56"-63" or 40"-45"	28-37 0-6	74"	46	16"
14-28 16-26	2 Row only	56"-63" or 40"-45"	28-37 0-6	74"	46	18"
26-26 to 36-36	1 Row only	40"-45"	25-33	56"-63"	47-52	18"
13-37 to 20-36	2 Row only	56"-63"	0-5	74"	32	26"

"Tread" is the distance between tracks measured center to center. (Or outside left to inside right.)

Track width less than 10" is undesirable, but can be used if the ground is firm.

Side-draft less than 20% is negligible, but side-draft becomes increasingly troublesome from 25% to 40%, and should never exceed 50% except for very heavy tractors.

The tabulation above does not include many of the older model tractors, some of which may serve very well for powering Marbeet harvesters.

Growers wishing to use these older models may be guided by this table if they will find the nearest equivalent tractor listed. It is important, however, that actual measurements be made of tread and track plate width, and that allowance be made for loss of power due to age or mechanical condition.

SPRECKELS SUGAR BEET BULLETIN

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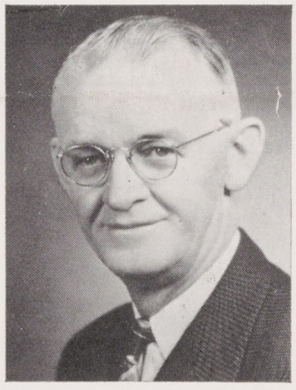
Vol. X SEPTEMBER-OCTOBER 1946 No. 5

SULFUR AND AMMONICAL FERTILIZERS ON LIGHT SOILS OF KERN COUNTY

By L. D. DONEEN[1] *and* M. A. LINDSAY[2]



M. A. LINDSAY

In 1945 a general investigation of irrigation and cultural practices was inaugurated in the potato- and sugar beet-growing districts of Kern County. The study was to include the penetration of water, as influenced by salt content and by the addition of soil amendments such as gypsum. While this survey was in the initial stages, it became obvious that some rather drastic results were being obtained from the use of sulfur. This phase of the problem was investigated in some detail, since sulfur is commonly used for reclaiming alkali land. With the possibility of using sulfur as a soil amendment in water-penetration studies, it was decided first to ascertain the residual effects of sulfur on the soil and on production, before initiating other experiments with sulfur. Therefore, the present report has been limited to the effect of sulfur and other acid-forming compounds on soil acidity, and to the effect of increased acidity on the nitrification of ammonia. The results obtained apply only to sandy soil, the chief type used for potatoes in Kern County.

L. D. DONEEN

Sulfur appears to be among the most practical materials used for increasing the acidity of the soils. It may be obtained in several forms, elementary sulfur (flowers of sulfur), soil sulfur, sulfur dioxide, sulfuric acid, and others. The percentage of sulfur in these materials varies with the different products (Table 1).

Ammonical fertilizers, when applied to the soil, will produce an acid. If used in large quantities or over a long period, they will increase the acidity of the soil. Among the chief ammonical fertilizers are ammonium sulfate, mon-ammonium phosphate, ammo-phos (commercial trade-

1. Assistant Irrigation Agronomist, University of California, Davis, California.
2. Farm Advisor, Kern County.

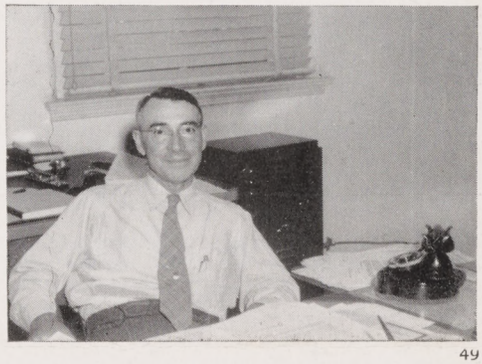
(Continued on page 39)

CONTROL OF GRASSHOPPERS AFFECTING SUGAR BEETS

By LEWIS BURTCH, *Agricultural Commissioner Kern County*

In order to protect sugar beet fields from serious damage caused by grasshoppers it is necessary to locate the breeding grounds and anticipate the problem well in advance of hatching time.

Sugar beet fields planted in areas along the margins of uncultivated land are particularly vulnerable to these attacks because the habits of grasshoppers are to lay their eggs in uncultivated, well-protected areas. Foothills and small canyons are particularly adapted to this habit, and eggs are laid about two inches below the surface of the soil in pods containing from 60 to 100 eggs. In the late summer and fall hoppers will migrate to these areas and usually around the base of small clumps of brush or rocks they will ream a hole, which is lined with mucus from their body, making it impervious to water, in which they will deposit their eggs. The eggs are then sealed over with this same moisture-proof secretion and lie dormant until early spring.



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LEWIS BURTCH

Hatching will depend largely on the temperature and usually starts around the first of April. If grass and other forage is abundant in the hatching area the young hoppers will remain in that area until the second or third molt before migration starts toward cultivated fields. In a year like this past one, where there was little or no grass and the ground was almost bare, young hoppers start moving on foot toward cultivated crops. Movement is quite rapid and they will cover as much as a mile in twenty-four hours.

Growers have found it quite successful to dig a trench along the edge of their property facing the migration. This is done with a regular ditch-digging machine such as is used in making ditches for concrete pipes, and the dirt is piled on the inside next to the crop. The migrating hoppers fall in the ditch and find it almost impossible to crawl over the pile of loose dirt above the trench. Spraying with kero-

(Continued on page 39)

Sugar Beet Production—Southern San Joaquin Valley

Cultural Practices Contributing to Successful Beet Production

Sugar beets are recognized as a staple agricultural crop in the Southern San Joaquin Valley, although it is a relatively new industry in this district. Beets have proven to be an excellent crop to use in rotation with potatoes, alfalfa and cotton. The success of the industry is the result of the use by growers of advanced agricultural practices, some of which are reviewed in this Bulletin.

Sugar beets are normally planted in this area during the months of December, January, February and March and are harvested during the months of July, August and September. Planting and harvesting dates in this territory differ from those in other districts in which beets are produced for the Spreckels Sugar Company, because of the higher temperatures that prevail in the district. At the time of this writing (August 22), beet harvest in this area is over 50 per cent completed and it is estimated that beet yields for growers producing for Spreckels this year will average between 21 and 22 tons per acre. Approximately 96 per cent of the 1946 beet crop produced for Spreckels in the Southern San Joaquin area is being harvested mechanically, the Company having 33 harvesters in the district.

The material for this issue of the Sugar Beet Bulletin was obtained or arranged for by Ward C. Waterman, Agricultural Superintendent, and Conner Gobel, Field Superintendent, Spreckels Sugar Company, in the southern district.

50

Fig. 1. It is general practice to level new land, apply gypsum, and install a concrete pipeline before the first crop is planted.

51

Fig. 2. Early fall pre-irrigation is usually an advantage. It germinates many weed seeds, thus reducing hoeing costs. It is necessary if calcium cyanamide is being used for fertilizer and insures a sub-moisture in the event of a dry winter.

52

Fig. 3. A combination fertilizer applicator and lister is applying 500 pounds per acre of ammonium sulfate in the beds.

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Fig. 4. The value of nitrogen to sugar beet production is demonstrated in this field. Mechanical failure of the fertilizer drill left two rows unfertilized for about 100 feet. Normal nitrogen requirements are from 100 to 125 units per acre.

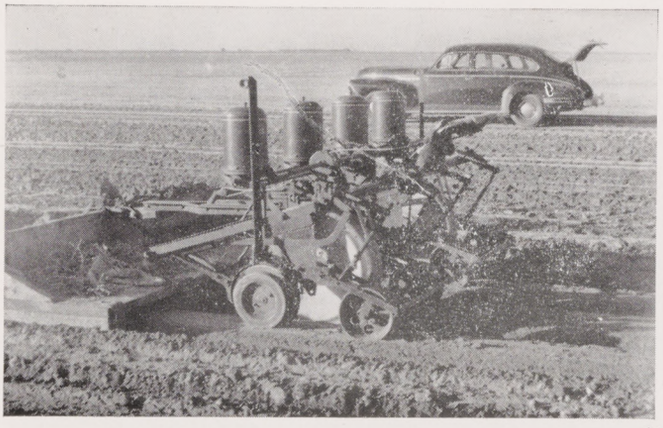

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Fig. 5. The entire Southern San Joaquin Valley acreage is planted on beds. Both the sled and wheel type planters are satisfactory for bed planting, particularly when the bed former and the planter are pulled as one unit. It leaves a good furrow for early irrigation.

55

Fig. 6. A sled type bed former and planter can be hooked together for planting in most Kern County soils which are relatively light in texture.

56

Fig. 7. If a ditch follows the field contour line, erosion is held to a minimum. Pipes set from the sub-ditch to the furrows save time and labor. During June and July, beets require an irrigation every four or five days.

57

Fig. 8. Penetration and erosion are controlled at the ends of the furrows by a cross ditch with a drain pipe which regulates the height of the water for eight or ten furrows.

58

Fig. 9. Water which accumulates at the ends of fields being irrigated is drained into a reservoir from which it is pumped back into the irrigation system.

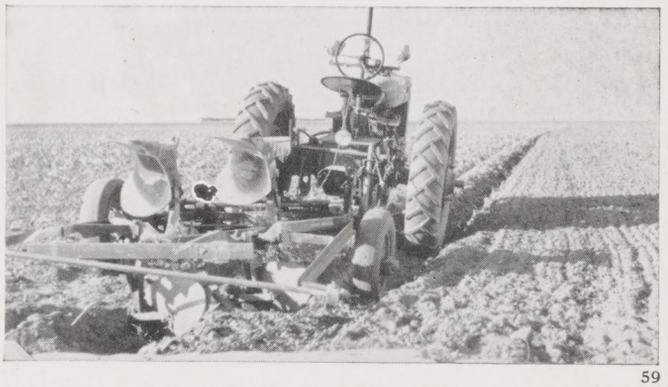

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Fig. 10. The "two-way" plow, by eliminating dead furrows in the center of the field, helps in keeping the field level, thereby making it possible to obtain more uniform distribution of irrigation water. A harrow pulled behind the plow frequently provides sufficient seed bed preparation to list the soil for planting.

APPLYING GYPSUM IS STANDARD PRACTICE IN KERN COUNTY

The application of gypsum (calcium sulfate) to Kern County soils is a general practice. It is used to wash out alkali and to maintain water penetration in soils irrigated with water containing excessive amounts of sodium. The application of calcium sulfate, a neutral salt, to the surface of the soil or in the irrigation stream maintains a favorable balance of salts for water penetration.

A top dressing of commercial gypsum immediately after planting minimizes crusting in the drill rows. The application of commercial gypsum in the irrigation stream at the well is a recent development that appears to be quite practical.

60

Fig. 11. It is common in the San Joaquin Valley to see gypsum piled on the edges of fields, preparatory to spreading on the land. Much of this gypsum is obtained from deposits in the Valley. The use of this material aids in improving the physical condition of the soil and minimizes the formation of surface crusts.

61

Fig. 12. Mechanical loaders and spreaders will handle 500 tons per day of pit-mined gypsum. From 5 to 15 tons per acre are applied in the fall or winter before land preparation is completed for planting.

62

Fig. 13. From 500 to 1,000 pounds per acre is the usual rate of application for broadcasting processed gypsum on top of the ground immediately after planting.

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Fig. 14. A machine to broadcast processed gypsum on the beds immediately after the sugar beets are planted. 500 to 600 pounds per acre of gypsum have been applied on the land in the background.

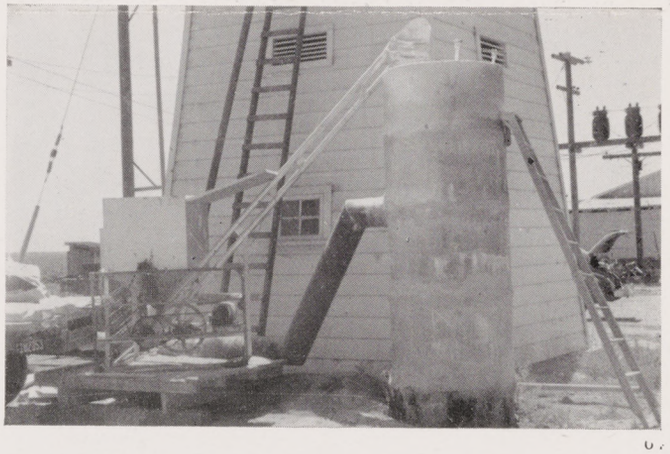


Fig. 15. A mechanical device to meter processed gypsum into the irrigation water. Harvester link chain elevates the material through a three-inch pipe from the hopper to the top of the standpipe.

CONTROL OF GRASSHOPPERS

(Continued from first page)

sene or burning with a weed burner in these trenches will destroy all of the hoppers collected in this manner.

It usually takes about six weeks from the time hoppers first hatch until they have completed the growth cycle and develop wings so that the movement is much more rapid. Protecting fields with trenches and use of poison baits on the hatching grounds has been the most satisfactory means of control. Sometimes in spite of all our efforts in attempting to stop the migration they will get through and cause considerable damage to the crops. They usually concentrate along the edge of the field and start feeding heavily. In this case we have recommended the spraying of the outside rows, usually about 100 feet in from the edge of the field. The most successful material we found for this work has been the use of 10 pounds of 50 per cent wettable DDT and 3 pounds Paris green with 2 pounds hydrated lime for each 100 gallons of water. This material is sprayed on at the rate of approximately 250 gallons per acre.

This is a very high concentration, but it takes severe treatment to check these insects, which are voracious feeders. This material will kill by contact or by absorption through their feet as they walk over the leaves in the beet field. It has been observed that kills have been obtained as long as 14 days after application as new migrations moved in after the first flight was killed. The Paris green, which is a stomach poison, was added to the solution to give protection after the DDT had lost its strength. DDT dust of 10 per cent strength applied at the rate of 40 pounds per acre has not proved to be very effective. Caution must be used in feeding the beet tops that have been sprayed with these materials, as there is danger of poisoning livestock in this manner.

It is always advisable to check with the Inspectors of the County Department of Agriculture well in advance of the season and be prepared for any emergency. Grasshoppers can destroy a field in a very short while, and if growers wait until they see the hoppers in the field before making any effort to control them they are likely to lose a large portion of their crop.

One of the most interesting attempts to protect fields from migrating hoppers is the one which Mr. Joseph Di Giorgio placed around the borders of his orchards and vineyards. After fighting hoppers for a number of years and suffering some very severe losses, he conferred with the County Agricultural Commissioner and asked for recommendations, which he agreed to follow to the letter. Our recommendation was that he leave a space on the outside where a trench like the one just described could be put in quickly, and inside the trench a hedge consisting of three rows of tamarisk trees, with a strip of alfalfa about 25 feet wide inside this hedge. This was done for a distance of eight miles, four miles along the eastern boundary of the property, three miles on the north and one mile on the south. This represented considerable expense and work, but when migrating hoppers started this season it was felt the expense was well justified and that saving to the crops had amounted to more than the cost of this barrier. We did not find it necessary to dig the trench. The trees were sprayed with DDT, poison bran baits were scattered on the ground under the trees and the alfalfa was sprayed with DDT. Many of the hoppers were killed in and under the trees. Quite a few got through the first barrier and into the alfalfa, but none got beyond that point.

This type of barrier would probably be more expensive than a number of growers could afford, particularly for field crops, but I believe it would be a very good investment in the case of orchards and vineyards in a territory where continued migrations from adjacent uncultivated fields has taken place for a number of years.

SPRECKELS ELECTS NEW OFFICERS

At a recent meeting of the stockholders of Spreckels Sugar Company, Mr. C. J. Moroney was elected President to succeed Mr. F. J. Belcher, Jr. For the past thirteen years during Mr. Belcher's presidency, Mr. Moroney has been Vice President and General Manager of the Company.

Mr. J. E. Coke, formerly General Agriculturist of the Company, was elected as First Vice President, and will be in Charge of Production. Mr. E. L. McKeany, formerly with Safeway Stores, was elected Vice President in Charge of Sales.

The Spreckels Sugar Company was incorporated in 1897, succeeding the Western Beet Sugar Company, which ten years previously had erected a beet sugar factory at Watsonville, California. Immediately after its incorporation, the Spreckels Sugar Company constructed its first factory, located at Spreckels, California. This is considered the world's largest beet sugar factory.

In 1917, the Company erected a factory at Manteca, California, and twenty years later, in 1937, erected a factory at Woodland.

The Company manufactures approximately 45 per cent of the beet sugar produced in California and approximately 10 per cent of the total beet sugar produced in the United States.

SULFUR AND AMMONICAL FERTILIZERS

(Continued from first page)

name), ammonium nitrate, and urea. These fertilizers do not depend upon sulfur to form the acid; in fact, only one of those mentioned above contains sulfur—namely, ammonium sulfate. This material is a neutral salt, and the sulfur contained therein plays no part in forming an acid soil. The same is true of gypsum (calcium sulfate), a neutral salt which contains sulfur, but which does not increase the acidity of the soil. The soil acidity is increased by ammonium nitrogen, and the degree to which these fertilizers will produce an acid soil depends entirely on the ammonia content. Since ammonium sulfate is among the chief nitrogen fertilizers used in this area, the investigations were concerned with it.

If fertilization by the use of sulfate is continued for several years, there will be a marked increase in acidity of the soil for a depth of 18 inches to 24 inches.

Table 1 indicates the effectiveness of the various acid-forming materials. The sulfur compounds that produce acid can be rated or compared according to the amount of sulfur they contain. This relative acidity rating is given in the last column of Table 1. The formation of acid soil from the ammonical fertilizers is due primarily to their ammonia content. This is listed in the table as the per cent nitrogen. The relative acidity, based upon pure sulfur as 100 per cent, appears in the last column of the table. Thus

(Continued on next page)

SULFUR AND AMMONICAL FERTILIZERS

(Continued from preceding page)

ammonium sulfate applied at the rate of 500 pounds per acre for 11 to 12 years would be equivalent to 1 ton sulfur in producing acidity. One application of 500 pounds ammonium sulfate would equal about 180 pounds pure sulfur or 360 pounds of soil sulfur or sulfur dioxide. Pure gypsum contains about 19 per cent sulfur (Table 1). This sulfur does not form an acid; it is combined with calcium, which forms a neutral salt, and most of it probably remains in the soil as a neutral salt. Even with large applications of gypsum, the soil acidity is not appreciably changed.

TABLE 1

Relative Acid-Forming Properties of Sulfur and Related Compounds and Ammonical Fertilizers

Form of Sulfur	Per Cent Sulfur	Pounds of Sulfur in One Ton	Relative Acidity[1] Per Ton
Sulfur (elementary)	100	2,000	100
Soil surfur (50%)	50	1,000	50
Sulfur dioxide (SO_2)	50	1,000	50
Sulfuric acid (H_2SO_4)	33	660	33
Ferrous sulfate ($FeSO_4$)	11	220	11
Gypsum[2] ($CaSO_4 . 2 H_2O$)	19	380	0
Ammonium Fertilizers	**Per Cent Nitrogen**	**Pounds of Nitrogen in One Ton**	
Ammonium sulfate	21	420	36
Monammonium phosphate	12	240	21
Ammo-phos	16	320	27
Ammonium nitrate	32	640	16
Urea (Uramon)	42	840	25

1. Relative acidity, based on pure sulfur as 100 per cent.
2. Gypsum has no appreciable effect on the soil acidity.

Ammonium sulfate by itself is a nitrogen fertilizer. It is also used in most mixed fertilizers as the nitrogen carrier. The ammonia from it is fixed in the soil and is not easily leached away by rains or irrigation water. The soil bacteria change the ammonia to the nitrate form—the form in which plants probably use the greater portion of their nitrogen. The acid is produced in changing the ammonium to the nitrate form. When the bacteria change the ammonia to nitrate nitrogen, the latter, being very soluble in the soil water, can be leached below the depth of the plant roots, especially where frequent irrigation is practiced. The changeover of ammonia to nitrate nitrogen by the soil bacteria is a rather slow process. Several weeks may elapse before an increase in nitrate nitrogen is evident. Where ammonium sulfate is used, the ammonia in it should be changed to the nitrate form by the end of 8 to 10 weeks. This slowness is desirable where ammonium sulfate is applied at the time of planting. Rapid nitrification of ammonia occurs in an approximately neutral soil. As the acidity of the soil is increased, the nitrification process slows down, and with extremely acid soils the nitrification practically ceases.

When 1,000 pounds of sulphur was applied to land having been fertilized with ammonium sulfate for a number of years, extremely high acidity was obtained, and the soils in these fields proved too acid for nitrification of ammonium fertilizer.

In some fields in Kern County, sulfur was found to have been applied in excess of 1,000 pounds per acre; in a few cases, as high as 2,000 pounds per acre had been used on old potato land. Where these quantities had been applied, usually there were few or no plants, or at best a very spotty stand—not more than 50 per cent of normal.

The acidity of the soil in these fields was found to be extremely high, and potatoes will not grow in soil of extreme acidity, nor will many other agricultural plants. The nitrification had been completely checked, since all the fertilizer was found to be in the ammonia form. The soil bacteria in these fields were unable to perform their normal function—that of changing ammonia to the nitrate form.

Although the potato plant will grow in soils relatively high in acidity, authorities generally agree that the best yields will be secured with a soil only slightly acid or neutral; fair yields, however, can be expected with moderately acid soils, whereas sugar beets grow best on neutral or alkaline soil and will not tolerate as strong an acid condition as potatoes. When the acidity of the soil is increased to the extent reducing nitrification, much of the ammonium fertilizer will remain in the soil unused. Under these conditions low yields are the result. Where organic matter such as weeds, vines, manure, and cover crops is plowed under, the process of decomposition will be progressively slower as the soil acidity is increased.

In some fields where the acidity has been brought extremely low by the use of excess sulfur on the soil or where ammonium sulfate has increased the acidity by long-continued applications, it may be found desirable to correct this acid condition. To correct high acidity of the soil, several forms of lime are used. The caustic type, generally preferred by the building trades, reacts faster in the soil than agricultural lime. The lime most commonly employed is ground limestone or the carbonate type. Table 2 shows the quantity that will neutralize the acid produced from a ton of the various forms of sulfur and ammonical fertilizers. Lime is only slightly soluble. When it is mixed with the soil, one will probably require considerably more than is indicated in the table, to return the soil to its original condition before the acid-forming material was applied. If ammonium sulfate is used at 500 pounds per acre, about 560 pounds of lime will be needed to neutralize the acid produced. With the application of 1,000 pounds of sulfur, more than 1½ tons of lime will be required. Lime reacts rather slowly, and it should be applied considerably before the planting date. To be most effective it should be finely ground or pulverized and well mixed with the soil. The quantity needed per acre depends upon the soil type and upon the degree of acidity to be corrected. Where an excess of sulfur has been applied to the soil, several tons of lime per acre will probably be required. Where the soil is acid from the continued use of ammonium sulfate, 500 to 1,000 pounds of lime a year would apparently be needed to maintain good productivity.*

TABLE 2

Pounds of Lime Required to Neutralize a Ton of Sulfur and Related Compounds, and Ammonical Fertilizers

Form of Sulfur	Per Cent Sulfur	Relative Acidity	Lime Required to Neutralize 1 Ton, Pounds[1]
Sulfur	100	100	6,250
Soil sulfur (50%)	50	50	3,175
Sulfur dioxide (SO_2)	50	50	3,175
Sulfuric acid (H_2SO_4)	33	33	2,040
Ferrous sulfate ($FeSO_4 . 7 H_2O$)	11	11	680
Gypsum ($CASO_4 . 2 H_2O$)	19	0	0
Ammonium Fertilizers	**Per Cent Nitrogen**		
Ammonium sulfate	21	36	2,250
Monammonium phosphate	12	21	1,290
Ammo-phos	11	17	1,090
Ammonium nitrate	35	17	1,100
Urea (Uramon)	42	25	1,680

1. These figures represent the theoretical quantity of lime required to neutralize the acidity formed. Because of the low solubility and incomplete mixing with the soil, considerably more lime will be needed to neutralize these same materials in the soil.

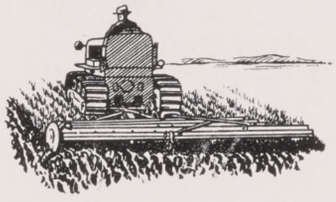
*Additional information concerning this subject may be secured from the Farm Advisor of Kern County.

SPRECKELS SUGAR BEET BULLETIN

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. X NOVEMBER-DECEMBER 1946 No. 6

ROTATE CROPS  TURN UNDER

"GREEN MANURE"  APPLY

FERTILIZERS  REAP GREATER

YIELDS OF SUGAR BEETS 

MORE ABOUT FERTILIZERS

By DR. G. F. MACLEOD, *Sunland Industries, Inc.*

Like taxes and vital statistics, articles about fertilizers go on forever. This is another attempt to present the supply situation with particular reference to California and at the same time to point out the importance of the fertilizer tag on a bag of fertilizer.

During and since the war, awareness of the interlocking fortunes and destinies of people the world over has needed no special emphasis. So it is with fertilizers. Supplies available to California growers are closely linked with world-wide, national and local stocks or capacity to produce chemicals. Time and space prevent more than the briefest consideration but perhaps even that may be worthwhile.

First let us consider the chief kinds of chemical fertilizers, classifying them as follows:

A. NITROGEN MATERIALS

1—Ammonia

	% N.
a. Ammonium Nitrate	32
b. Ammonium Sulfate	20
c. Ammonium Phosphate	11 or 16
d. Anhydrous Ammonia	82
e. Ammonia Solutions	30

2—Nitrates

a. Ammonium Nitrate	32
b. Calcium Nitrate	15
c. Potassium Nitrate	12 (44% K_2O)
d. Sodium Nitrate	16

3—Organics

a. Cyanamid	21
b. Urea (Uramon)	42
c. Bloodmeal	
d. Fishmeal	
e. Cottonseed meal	
f. Tankage, etc.	

(Continued on next page)

MORE ABOUT FERTILIZERS

(Continued from page 41)

B. PHOSPHATE MATERIALS

	% P_2O_5
1. Superphosphate	18-20 or 40-50
2. Ammonium Phosphate	48
3. Calcium Metaphosphate	60
4. Phosphorous	230
5. Potassium Metaphosphate	50

C. POTASH MATERIALS

	% K_2O
1. Sulfate of Potash	48
2. Muriate of Potash	50
3. Manure Salts	25

This list is by no means all-inclusive, but does cover the principal sources of commercial fertilizer materials. The figures at the right of each compound give approximate contents of plant foods in terms of nitrogen (N), phosphate (P_2O_5) and Potash (K_2O). As can be seen, there is a wide choice of materials for blending or mixing commercial fertilizers about which more will be said later.

The world supply of fertilizers can best be presented by quoting estimates of the U. S. Department of Agriculture through its connection with the Combined Food Board: "World deficits of approximately 457,000 short tons of nitrogen and approximately 3,100,000 long tons of phosphate rock. World supplies of potash will be adequate only if the prewar level of production in Germany can be realized and the necessary transport can be mobilized." This is news to no one. The world, like us, is short of fertilizers of all kinds.

As for the United States, fertilizer sales during 1945-46 were 10 per cent greater than in 1944-45. Increases of from 2 to 14 per cent in amounts of the three primary plant foods are indicated for 1946-47. Briefly, the table looks like this:

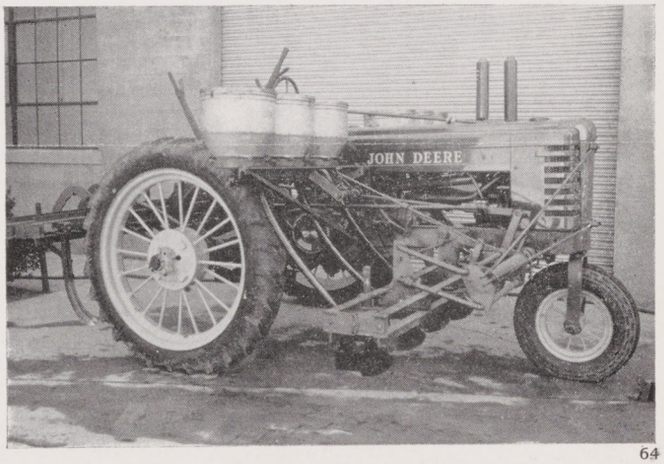
PLANT FOOD	1945-46 Supply (Tons)	1946-47 Supply (Tons)	Per Cent Increase
Nitrogen (N)	699,118	715,908	2
Phosphates (P_2O_5)	1,317,350	1,500,000	14
Potash (K_2O)	726,773	766.009	5
Total	2,743,241	2,981,917	9

The forward picture is an estimate based on no strikes, no transportation difficulties, no unforeseen handicaps.

While the situation in California must of necessity follow the world-wide and country-wide picture, fluctuations because of primary sources of supply must be expected. The bulk of primary material production is in the east and in Canada. Our local supply cannot begin to meet demand in general. We are dependent upon eastern and Canadian production for nitrogen in a large part; we have, until recently, been deficient in phosphate production, particularly the double or "treble" superphosphate and, while potash production here would meet demand normally, the return of potash to allocation by the Civilian Production Administration means a potash deficit for California farmers.

In 1940 California consumed 218,589 tons of fertilizer. Last year, five years later, we used 483,716 tons. For the first quarter of 1945 a total of 125,438 tons of commercial fertilizer was purchased and in the same period this year 153,331 tons were sold. This by no means satisfied grower demands, as everyone knows.

When we look at the various individual materials the reasons for unsatisfied grower reactions are obvious. We rightly like to use ammonium sulfate. In 1943 we got 72,503 tons, in 1944 108,222 tons and in 1945 only 71,206 tons. We shall be lucky if we get 70,000 tons in 1946-47. In 1945 we received only slightly more of the desirable ammonium phosphate materials than we did in 1941 with a tremendously increased demand. Ammonium



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Row crop tractor mounted with modern fertilizer distributing equipment.

nitrate product, which was first used in amounts in California in 1943, has gained steadily in tonnage and will unquestionably find increased acceptance among growers. There are two reasons at least for this:

1. The War Department will operate from government-built, synthetic ammonia plants to produce fertilizer for the occupied zones of Germany and Japan in 1946-47. The other six plants have been sold or leased to private industry for fertilizer production. This means increased availability of ammonium nitrate.

2. With proper conditioning and proper packaging we now have an economical and physically desirable form of high nitrogen content fertilizer which contains both nitric and ammoniacal nitrogen, i.e., ammonium nitrate.

This brings us to a consideration of the fertilizer tag and its value to growers. There are four elements on every package of fertilizer sold in California, required by law. This law is impartially and vigorously enforced by the California State Department of Agriculture, Bureau of Chemistry. The law requires on the label or tag on every bag the following:

a. The name, brand and trade-mark, if any, under which the commercial fertilizer or agricultural mineral is sold.

b. The name and address of the *registered* producer, manufacturer, importer or dealer.

c. The place of manufacture or production.

d. A chemical analysis, stating the percentages of *every* constituent of agricultural value claimed to be therein, and the materials from which all of said constituents are derived.

(Continued on next page)

MORE ABOUT FERTILIZERS

(Continued from preceding page)

It is the last, or above, to which we should devote the immediate discussion.

Both growers and fertilizer salesmen often talk glibly of "16-20, 11-48, 17-7-0, 10-10-5," etc., without really stopping to think what these figures actually mean. They are the "constituents of agricultural value" for which you pay your money. It is customary to keep the figures in definite and uniform order—N, for nitrogen, comes first; P for phosphorous, expressed as P_2O_5, sometimes erroneously called "phosphoric acid," and K, for potash, expressed as K_2O in that order. These figures are the percentages by weight of primary plant foods designated as the N-P-K ratio on the bag you buy. For example:

In a 100-pound bag of 10-10-5 there is 10 per cent or 10 pounds of nitrogen, 10 pounds of P_2O_5, or "phosphate," and 5 pounds of K_2O, or "potash." The balance is filler or necessary chemicals to make a usable mixture. Reputable fertilizer manufacturers see to it that this is not sand, but rather a wide variety of different and useful compounds are employed. Let us look a little further into the formula.

The law requires that the source of this 10 and 10 and 5 pounds of available plant food be indicated on the tag. Refer now to the list of fertilizer materials given at the start of this discussion and you will see that a manufacturer has many choices as to what shall be his source of nitrogen in his particular mix. The same holds for the phosphatic and potassic materials. What he chooses to use may be of the greatest importance to you and you must be informed as to the nature of his choice. That is the law. Do you take advantage of this?

GUARANTEED ANALYSIS (%)					
NITROGEN				Phosphoric Acid	Potash Water Soluble
Nitrates	Ammoniacal	Organic	TOTAL	Available	From Sulphate
1	9		10	10	5

Each bag of fertilizer sold in California is required by law to have attached to it a tag providing certain specified information, including the guaranteed chemical analysis of the fertilizer.

Look at the tag on the next bag of fertilizer you buy. There are three sources of nitrogen:

1. Nitric nitrogen.
2. Ammonic nitrogen.
3. Organic nitrogen.

Perhaps, if you want a quick-acting fertilizer you want most of your nitrogen from a "nitric" source, or for longer action from an "ammonic" source or even from an "organic" source. Each form has its own particular advantages and if you are uncertain of your specific needs consult the authority of your choosing as to what will best fit your particular requirements, then buy accordingly. In the case of phosphate you are most interested in the guarantee as to *available* phosphoric acid. The source is almost always superphosphate, either single or double, although there are both organic and other manufactured forms. Those who have alkaline soils prefer to use potassium sulphate or sulphate of potash rather than muriate or potassium chloride. The sulfur in the sulphate is considered beneficial and some of our soils already have detrimental "chlorides" in them. The relatively small amounts of potash needed in mixed fertilizer or in any other form on our comparatively virgin soils of the west make the choice of potash sources a rather unimportant matter. The tag will show you which form was used to make any given batch of fertilizer.

It should be emphasized that with the long-standing and continued shortages of primary fertilizer materials many manufacturers cannot exercise the choice which they would normally enjoy. Therefore, as a temporary expedient, they use any form of nitrogen or potash available at the moment. This is frequently done of necessity rather than choice at the present time. Furthermore, there are very definite chemical reactions which prohibit the mixing of some "higher grade" fertilizers. The amount of ammonia which superphosphates will "hold" without reconversion is an example. Certain combinations of materials "set up" or become useless through caking, other mixtures are explosive. These and many other similar factors all help to make the reputable fertilizer manufacturer a scientist rather than an artist.

We hear much about the acidity or basicity of fertilizers and their effects upon soils. It is common practice to calculate the required formula to produce a basic, an acid or a neutral fertilizer. These simple facts may be helpful in reading and interpreting your fertilizer tag in terms of your needs:

1. Cyanimid, nitrate of soda, nitrate of potash, calcium nitrate, all tend to make a soil more basic and less acid.

2. All ammonical salts, that is, ammonia sources of nitrogen, sulfate of ammonia, urea, blood, cottonseed meal, fishmeal, tankage, ammonia solutions and anhydrous ammonia, tend to make a soil more acid and less alkaline.

3. Superphosphates, both double and single, have no permanent effect on soil reaction.

4. Common potash salts such as muriate, sulphate, manure salts and Kainit have no residual effect on soil reaction.

In general the use of mixed fertilizers will not materially change the soil reaction because they represent only a small amount of the total mass in any given acre of ground. However, continued use of simples such as ammonium sulfate or nitrate of soda on intensively cropped land over a period of years may result in definite shifts, particularly in light, sandy soils.

It has not been possible to treat any of the subjects here raised in more than telegraphic style.

An attempt has been made to point out the continuing shortages of materials with an ever-increasing demand for fertilizers. Only the most generalized discussion of various materials has been offered in what may be an over-simplified and elementary manner. To undertake definite recommendations for sugar beet culture requires a more intrepid spirit than the writer possesses or wishes to assume when the innate variability of growing conditions is recognized. There are, however, certain definite values to be gained from a more careful study and complete understanding of the tags and labels on fertilizer bags. Perhaps this discussion will have been justified if it serves to call the attention of the fertilizer buyer to his protection in the purchase of one important item in the tremendously complex job of food production.

DECLINE OF SOIL FERTILITY

By HANS JENNY, *Division of Soils, University of California*

Agriculturists often distinguish between soil fertility and soil productivity. The former term refers to the nutrient content of the soil, whereas the latter to the crop yield that can be produced on a given soil under certain growth conditions and soil management practices. A soil may be rich in nutrients (high fertility) but may not produce anything because of lack of water or excess of alkali. Such a soil is said to be fertile but unproductive.

The distinction between soil fertility and soil productivity is probably not fundamental, but it is convenient in agricultural parlance. Thus, the application of fertilizers is said to augment soil fertility, whereas soil leaching and removal of nutrients by crops is said to diminish it.

Decline of soil fertility is widespread and generally recognized, but not easily demonstrated with reliable figures. Indirect evidence is, of course, readily obtainable. All we need to know is the chemical composition of the crops harvested and the amount of produce removed from the land. Thus, 15 tons of sugar beets contain 115 lbs. of nitrogen, 45 lbs. of phosphoric acid, and 145 lbs. of potash. These amounts must have come from the soil. The soil will be impoverished by these quantities of phosphorus and potash, and to some extent also in nitrogen. The nitrogen problem is complicated by soil rejuvenation as a result of biological fixation of nitrogen from the air.

Decline of barley yields (lower curve) and of soil nitrogen (upper curve) under systems of continuous cropping.

Other means of ascertaining declines in soil fertility are the comparisons of crop yields from year to year. To be sure, yields are indicators of soil productivity, but under comparable conditions it is sometimes permissible to conclude that declining yields are caused by lowered soil fertility. Declining yields are often masked by improvements in varieties and better soil management methods; that is to say, soil fertility may drop faster than the yield reductions would indicate.

The graph above shows the results of a carefully controlled experimental study on declining soil fertility. Fresno fine sandy loam from the San Joaquin Valley was cropped continuously to Beldi barley. No fertilizer was added. Every year yields and certain soil constituents were carefully measured and analyzed. The soil was not virgin but had been cropped previously for a number of years so that the fertility level must have been higher prior to

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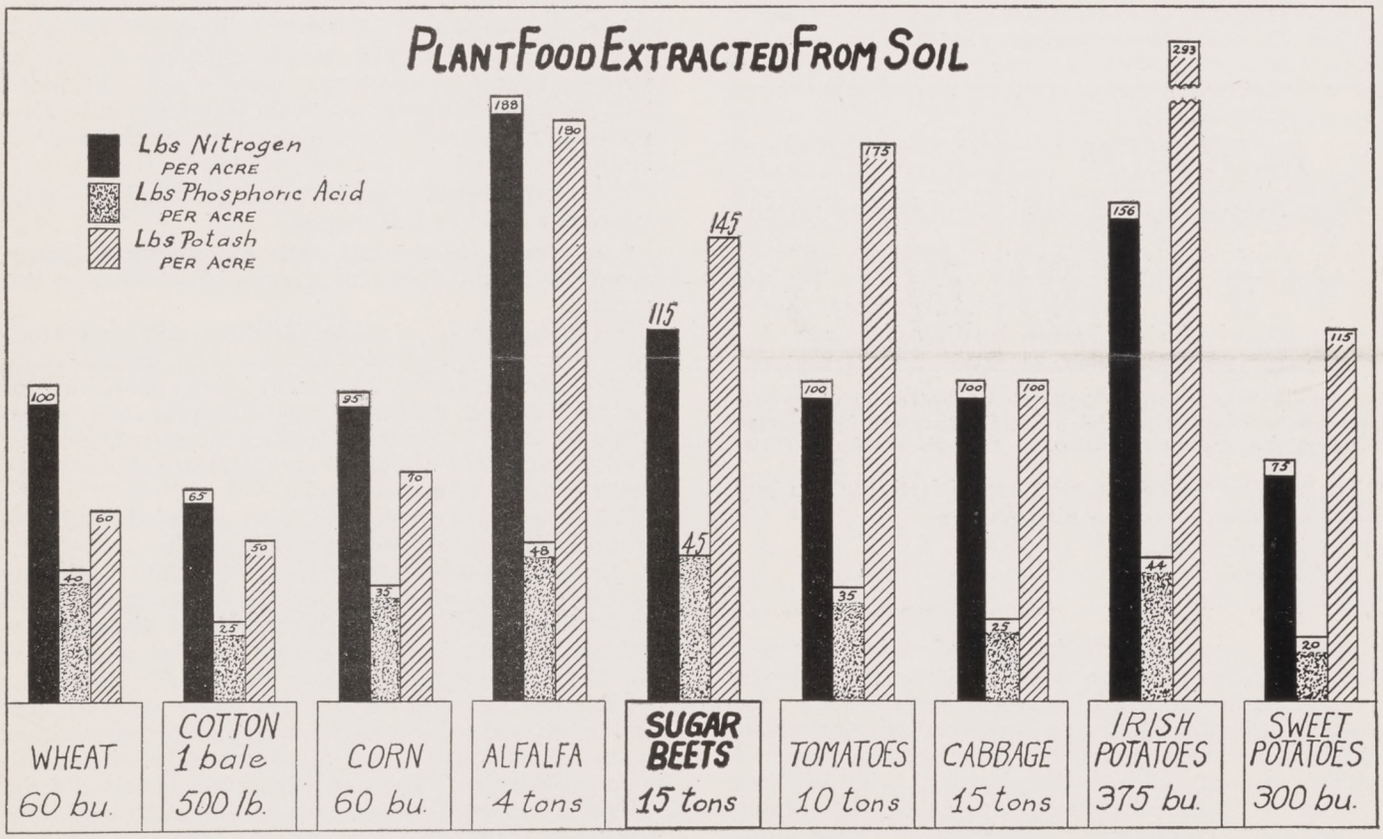

DIFFERENT CROPS EXTRACT VARIOUS AMOUNTS OF THE THREE MAJOR ELEMENTS, NITROGEN, PHOSPHATE and POTASH, FROM THE SOILS IN THE PRODUCTION OF AVERAGE TONNAGES.
THE CHART ABOVE SHOWS THE COMPARATIVE DIFFERENCES IN AMOUNTS EXTRACTED BY A NUMBER OF THESE CROPS.

Courtesy American Potash Institute, Inc.

DECLINE OF SOIL FERTILITY

(Continued from preceding page)

1914, when the experiment began. The yield curve (productivity curve) and the soil nitrogen curve (fertility curve) reveal a marked decline. These results are in harmony with similar studies conducted in various parts of the United States. They all show that the reduction in yield and soil fertility are most marked at the beginning of cultivation. In subsequent years the decline becomes less pronounced and gradually a steady state is being approached. It means that soil fertility becomes stabilized, but at a level much lower than the virgin state.

In the above-mentioned experiment, crop and soil analysis shows that the losses of soil nitrogen are greater than can be accounted for by crop removal. The average extra loss per season to a depth of 9 inches was about 100 lbs. per acre. Similar losses have been reported for soils in New Jersey. Fortunately, the intensive development of the fertilizer industry since the turn of the century enables the farmer to overcome declining soil fertility on an economically feasible basis.

EFFECT OF COVER CROPS FAR REACHING

By A. A. TAVERNETTI, *Farm Advisor, Monterey County*

Cover cropping, or more properly termed green manuring, should be considered in the light of soil conditioning rather than fertilizing. The response of plants for some years following turning under green vegetation is greatly in excess of that obtained by the application of the same quantity of plant nutrients in commercial forms. This is due, no doubt, to active decaying organic matter stimulating desirable flora in the soil, which in turn makes available plant nutrients.

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A good stand of vetch for cover crop planted dry on ridges, followed by an irrigation.

Sugar beets generally require utilization of the land for a full year; therefore, it is not always practical to have a cover crop on the land just preceding the planting of the crop. This is hardly essential, as beneficial results will be obtained even if the cover crop may precede the actual planting by even two or three years.

It is usually more practical to plant a cover crop following the harvest of sugar beets rather than before. Obviously, a rotation of crops is required in which sugar beets is one of several crops.

A common crop rotation and cover crop practice is to seed the land to vetch, clover or similar leguminous plants immediately following sugar beet harvest. The winter rains are usually sufficient to germinate and mature the cover crop in time to be turned under in March of the following year. Beans, vegetables, tomatoes and many other spring-seeded crops are planted immediately following the cover crop. The next year the land is again planted to sugar beets. However, it is preferable that the same land not be planted to beets more than once in three years due to the danger of building up sugar beet nematode as well as other insects and diseases peculiar to beets. A cover crop following beets greatly simplifies the problem of eliminating volunteer seed from bolting beets as well as seed from weeds which frequently mature by the time the beets are harvested.

One of the most economical and best cover crop plants is *Melilotus indica,* a clover, which can be broadcast at the rate of about 20 pounds per acre to the land following harvest without any cultural practice either before or after seeding. The winter rains germinate the seed without need of covering. The plant grows slowly during the winter months and may be disappointing until rapid growth gets underway about the middle of February. In tests, it has out-yielded other legumes, provided it was allowed to grow to full maturity.

In combination with commercial fertilizers, cover cropping has greatly expanded the area of soils suitable for growing beets. Particularly is this true of the more shallow soils from which yields in excess of twenty tons per acre are not now uncommon, which were formerly not considered desirable for sugar beets.

CULTURAL, IRRIGATION, AND FERTILITY PRACTICES AFFECTING SUGAR BEET YIELDS

Associate Irrigation Agronomist, University of California

By L. D. DONEEN

A number of factors enter into successful sugar-beet growing in California. Some of these component factors are not controllable by man, such as climate, soil type, natural fertility, etc., whereas others are entirely or somewhat under the control or influence of man, such as cultural practices, soil moisture and fertility. Many of these factors are interrelated, and any one may directly or indirectly influence the other. For maximum yields the grower must judiciously select the right combination of factors. For example, with a soil of low fertility, the application of fertilizers will be the factor which will determine the yield, assuming other conditions are favorable, or fertility may be naturally high in the soil or from the addition of fertilizers, but the irrigation schedules may not maintain adequate soil moisture for maximum yields.

The planting of beets on ridges or on the flat will be determined to a large extent by local conditions. In areas where many crops are customarily planted on ridges, beets will generally follow this practice. In localities where bed plants are not the rule, beets usually will be planted on the flat. In general, ridge planting lends itself to better

(Continued on page 48)

ORGANIC MATTER IMPORTANT IN FERTILIZER PROGRAM

By R. S. LAMBDIN, *Asst. Agricultural Superintendent Spreckels Sugar Company*

The proper planning in maintaining soil fertility is becoming more and more essential as costs of production in some phases of farming are steadily rising. A well-balanced fertilizer program helps to increase net return by increasing yields.

In determining a well-balanced fertility program, it is important to incorporate the use of organic matter. In the Salinas district, where manures are used extensively, contractors haul the manure in large trucks equipped with spreaders. A flat rate per ton based on the length of haul is charged for hauling and spreading. Growers having a livestock unit in their farming program should make an effort to use the manure on their own ranch. Barnyard manure is an excellent source of organic matter, but when cover crops can be worked into the rotation, they are equally satisfactory and often less expensive. With a little planning cover crops can usually be included in a crop rotation program.

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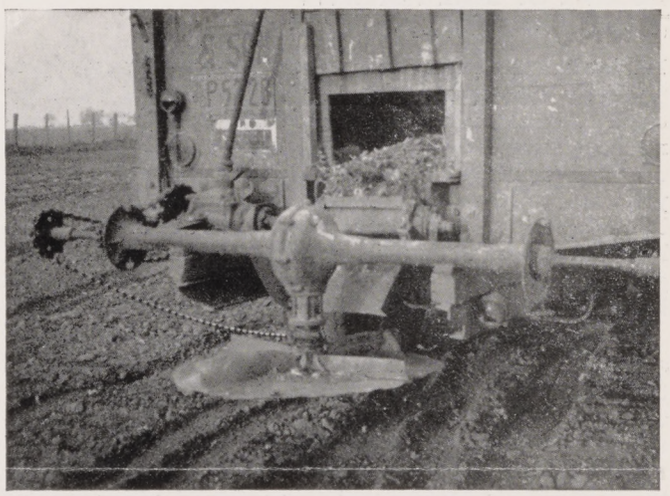
Manure spreader with spinner distributor used extensively in the Salinas Valley area. Factory waste lime can be spread with this equipment.

The use of lime or gypsum as a soil conditioner is essential in some classes of soil. Factory waste lime applied at rates of 5 to 10 tons per acre is showing some excellent results and is an ecomonical soil conditioner. The Spreckels Sugar Company makes factory waste lime available to its growers and it can be efficiently hauled and spread with the same type of equipment used in manure handling.

The use of commercial fertilizers is necessary in a fertility program, but if they are to do their maximum work, they must be used in connection with a program of building up the organic matter content of the soil.



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Detail of spinner attached to rear of truck in spreading manure or waste lime.

JOHN C. LARSEN, JR.

The Spreckels Sugar Company and the numerous friends of John C. Larsen, Jr., feel keenly the loss of Mr. Larsen, who died at his home in Woodland on September 19, 1946.

For the past sixteen years, Mr. Larsen had been employed by the Spreckels Sugar Company as Field Superintendent and during this time had earned the admiration and respect not only of the company by whom he was employed but of his many friends and business associates.

John Larsen was born in Logan, Utah, in 1877, attended the Utah State College, and spent practically the entire remaining portion of his life assisting beet growers in Utah, Wyoming, and California in the production of sugar beets, while serving as a representative of various beet sugar companies.

In addition to his wife, Mrs. Hattie Larsen, Woodland, Mr. Larsen is survived by the following children: Mrs. W. Carvel Johnson, Salinas; John Byron Larsen, Field Superintendent for the Company in King City; Mrs. Clark Greenhaughl, Salinas; Richard and Frances Larsen, Woodland.

THIS ISSUE

The material for this issue of the Spreckels Sugar Beet Bulletin was assembled by Mark Raney, Agricultural Superintendent in the southern San Joaquin Valley, and C. E. Crane, Agricultural Superintendent in the Salinas Valley.

COVER CROP RECOMMENDATIONS

Cover crop recommendations for different areas in California depend to a large extent upon soil, climatic and growing conditions. County farm advisors throughout the state have developed for their particular counties recommendations on the use of cover crops. Following are the recommendations for typical counties in the beet-growing areas.

* * *

COLUSA COUNTY—John Fiske, Farm Advisor.

"Burr clover, which is a natural in the area, is one of our best cover crops. A fall irrigation may be necessary to give it a good start. We also like Melilotus Indica (sour clover) and have had very good luck with Austrian and Canadian peas. Vetch is also a good crop, but I have seldom seen it do as well as these others."

Mr. Fiske also adds the following very sound advice on cover crop management: "It seems to me the important thing to stress in connection with any of these crops is that the grower should get them turned under when they are in a green and succulent state. Too many growers attempt to get a little extra growth and by the time they get the cover crop under it has matured to a point where they get a nitrogen tie-up which is about as bad as not growing a cover crop at all."

* * *

YOLO COUNTY—Warren D. Norton, Farm Advisor

"For fall planting, Fenugreek is probably the most likely to give satisfactory yields of cover. More green tonnage may be obtained by planting some barley, possibly 10 pounds per acre, with the Fenugreek on fields where one would be uncertain of the legume yield. Purple vetch and early Melilotus are also good yielders.

"For summer cover crops, the Brabham and Iron cowpeas have usually yielded well, as have blackeyes in late planting. Minsoy and Virginia soybeans have produced excellent yields of dry matter. While soybeans are often attacked by red spider and are a favorite food of rabbits, they will warrant more attention when seed becomes more available."

* * *

SAN JOAQUIN COUNTY—J. P. Underhill, Asst. Fm. Advisor.

"In San Joaquin County cover crops have not been used very extensively because of the difficulty of fitting them in with the sugar beet program. Cover crops such as vetch and Melilotus Indica have been grown successfully and profitably with other crops and should be of much benefit to sugar beets if worked into the crop rotation program.

"Common or purple vetch and Melilotus Indica planted after the beet crop is harvested and allowed to grow until March will produce a good growth of foliage which can then be plowed under and irrigated and then thoroughly disked to compact the soil and hasten disintegration. The land will then be ready for a late planted crop such as beans.

"Many crops are grown in rotation with sugar beets with very good results. Probably those which are most used are alfalfa, barley, tomatoes and beans."

* * *

STANISLAUS COUNTY—A. A. Jungerman, Farm Advisor.

"Fall cover crops are usually planted on ground which has been furrowed out. Following the broadcasting of the seed and a light harrowing, water is run down the furrows in order to germinate the seed.

"Yellow mustard, purple or common vetch and sour clover are the common fall cover crops used. Our trials show that these should be seeded before November 1 in order to get the best results. Fenugreek may not make the tonnage that these others do, but it can be seeded later and make a fair stand."

* * *

TULARE COUNTY—Ralph L. Worrell, Assistant Farm Advisor.

"The best cover crop for this county is a mixture of purple vetch (30 pounds per acre) and barley (15 pounds per acre). Other leguminous cover crops which may be used are: Melilotus Indica (15 pounds per acre) and Canadian or Austrian field peas (50 pounds per acre).

"A preirrigation or an irrigation just following planting is usually practiced."

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KERN COUNTY—M. A. Lindsay, Farm Advisor.

"We suggest the following plants for cover crops: Summer cover crops—Sesbania, cowpeas, including the blackeye bean and pigeon peas. Bean and pea crops should be planted prior to July 1. Fall cover crops—Mustard, Canadian field peas, vetch, oats and vetch, and oats and barley."

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SAN BENITO COUNTY—Roy D. McCallum, Farm Advisor.

"Cover crops have not been used extensively in this area, although some of the more progressive growers are now planting vetch following the harvesting of sugar beets. I believe as we approach more normal conditions, the more progressive growers will attempt to have a cover crop planted at least one year in four."

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MONTEREY COUNTY—A. A. Tavernetti, Farm Advisor.

"Cover cropping is a generally accepted beneficial practice in Monterey County. We suggest the following plants as the most satisfactory in this area: The vetches, Melilotus Indica, barley (either alone or mixed with one of the above)."

PRACTICES AFFECTING YIELDS

(Continued from page 45)

irrigation practice. This is evident if the land is not well leveled. Flat planting with 20-inch spacing of rows does not allow sufficient distance between rows for adequate irrigation ditches, resulting in partial flooding of the low areas and insufficient soil moisture for the higher portions of the field. If flat planting is to be practiced, it is a better policy from an irrigation standpoint to plant on the spacing of 14 and 26 inches with the irrigation furrow in the 26-inch space. This wider spacing of alternate rows permits the use of a deeper, wider furrow and should improve the irrigation practice by preventing the flooding of one furrow into another. A cultural practice should be adopted that will give as uniform a distribution of irrigation over the field as possible and with a minimum of labor. Bed planting or the 14- and 26-inch spacing on the flat results in half the number of irrigation furrows when compared with the flat planting using 20-inch spacing and should give a reduction in irrigation costs.

In the production of beets, the irrigation schedule is of prime importance. Beets will use the available water over a wide range, but, of course, the sandy soils usually hold less water than the heavier clays and will consequently require frequent light irrigations as compared with the clay soils. Experiments indicate that as soon as the beets wilt, growth is stopped, and the extent of checking of growth depends upon the prolongation of the drought. Beets suffering from water shortage to the extent of killing leaves will not only check the growth for this period but also for a considerable period after the addition of water. This is due to the fact that it is necessary to replace the dead leaves with new ones before maximum growth of the beet root is resumed. For maximum growth and yield, sugar beets should never be allowed to wilt except for a few days previous to harvest. Sugar beets will use all the available moisture to a depth of 4 to 6 feet before wilting, and for economical production, most of the available water should be utilized to this depth before replenishment. This means the intervals between irrigations should be as long as possible without causing wilting. Each irrigation should wet all the dry soil.

In many sugar-beet fields certain areas will wilt before the field as a whole shows signs of a water shortage. This condition may be due to different soil types, but more often to an uneven distribution of irrigation water. In some cases this may be remedied by better irrigation furrows, as mentioned above, or by better control of the quantity of water entering the individual irrigation furrows from the head ditch. This may be accomplished by placing a short piece of pipe or a small box for each furrow through the ditchbank or by using 2-inch siphons to siphon the water over the ditchbank to the furrows. These siphons are particularly adaptable to row irrigation as they are light and can be moved across the field as the irrigation progresses. With the adjustable gate on the siphon, sufficient water can be maintained in the furrow for as long as necessary to obtain the penetration desired without an excess of water flooding the beets.

The quantity of water added to the soil and the frequency of the irrigations may have a marked influence on the fertilizer practice. For example, a fertilizer applied in the nitrate form, such as sodium nitrate or calcium nitrate, is entirely soluble, and followed by heavy applications of water will cause some leaching of the soil with the removal of this fertilizer below the rooting depth of the beets. If nitrate fertilizer is applied at the time of planting the beets, some of this nitrogen may be leached below the young roots by rains or first irrigations. When nitrate fertilizer is to be used, it would probably be best to apply it as a side dressing after thinning or after the first irrigation.

The ammonium fertilizers, such as ammonium sulphate, ammonium phosphate (uramon), or ammonium gas, are fixed in the soil, or tied up with the soil particles, and are not readily leached by excessive applications of water. After several weeks the ammonia nitrogen is slowly changed to the nitrate form by bacteria in the soil. In this nitrate form it can be removed by leaching. If the fertilizer is placed in bands, this nitrification, that is, the changing of ammonia to the nitrate form, appears to be slowed down when compared with mixing with the soil. This slowing down of nitrification in the bands is desirable when fertilizing at planting time, as it releases the nitrates over a longer period of time and gives the beets a chance to utilize them before they are removed by excess rain or irrigation water. Because of the fixing power of the soil for ammonia and its rather slow nitrification, it should be applied some time ahead of the time the plants will need it. Thus the ammonia type of fertilizer should be applied at the time of planting. The nitrate fertilizer could be applied rather late in the season as it usually gives a quick response in growth.

A fertilizer is appearing on the market as ammonium nitrate. In this fertilizer the ammonia will be fixed in the soil, while the nitrate will be soluble. This should be a good fertilizer to add just after thinning or any time in the early part of the growing period as the nitrate is immediately available for the young plant, and the ammonia will act as a reserve later in the season.

Some of the ammonium fertilizers are applied in irrigation water, particularly hydrous ammonia.

When ammonium fertilizers are applied in the water, ammonia is fixed in the surface inch or two of soil and will remain there until it is nitrified to the nitrate form, in which form it may be leached by subsequent irrigations deeper into the soil where the main root system of the beet is located. Nitrification will not take place in dry soil. Therefore, when ammonium nitrogen is fixed in the first inch or so of soil, and it is rapidly dried by hot weather and winds, it will remain in the form of ammonia and may require rather frequent irrigations to keep the surface of the furrow moist for rapid nitrification. If this is not done, the ammonia will stay in this form fixed in the surface inch of soil and not reach the root system. Therefore, any ammonium that is applied in the irrigation water should be applied sufficiently early to allow nitrification to take place under wetting and drying conditions found in the field. In some cases this may mean a month or more delay before the plants will obtain the nitrogen.

As indicated above, many factors may influence the yields of sugar beets, and these factors cannot be considered independently but in relation to other practices. Cultural and irrigation practices should be considered together as either one may have considerable influence on the other. The application of fertilizer should be recognized as complementary to the irrigation practice. Good fertilizer practice may be nullified by an inadequate water supply or poor cultural practices such as weed growth.

SPRECKELS SUGAR BEET BULLETIN

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

1946 INDEX

CULTURAL

DISEASES AND PESTS

AGRICULTURAL DEPARTMENT—SPRECKELS SUGAR COMPANY

Addresses and Telephone Numbers

NAME	TITLE	ADDRESS	TELEPHONE
		Spreckels Sugar Company	
J. E. Coke	*General Agriculturist*	*2 Pine St., San Francisco*	*DOuglas 5600*
		600 California Fruit Bldg.	
A. A. Armer	*Agricultural Engineer*	*Sacramento*	*Sac. 3-2021*
LeRoy Powers, Ph.D.	*Plant Breeder*	*Spreckels, California*	*Salinas 7321*
Henry Sevier	*General Labor Supervisor*	*2 Pine Street, San Francisco*	*DOuglas 5600*

SALINAS DISTRICT

G. P. Wright	*District Manager*	*Spreckels Sugar Co., Spreckels*	*Salinas 7321*
W. H. Paulsen	*Agricultural Superintendent*	" " " "	" "
C. E. Crane	*Agricultural Superintendent*	" " " "	" "
Ralph Lambdin	*Asst. Agricultural Superintendent*	" " " "	" "
G. C. McCandless	*Field Superintendent*	" " " "	" "
Robert Flores	*Field Superintendent*	" " " "	" "
W. B. Marcum	*Field Superintendent*	" " " "	" "
H. H. Voth	*Field Superintendent*	" " " "	" "
F. R. Behringer	*Labor Superintendent*	" " " "	" "
Wm. J. Redding, Jr.	*Asst. Agricultural Engineer*	" " " "	" "
J. B. Larsen	*Field Superintendent*	*P. O. Box 87, King City*	*King City 72-F2*
C. M. Locke	*Field Superintendent*	" " " " "	" " "

SACRAMENTO DISTRICT

		Spreckels Sugar Company	
H. F. Melvin	*District Manager*	*600 California Fruit Bldg., Sacramento*	*Sacramento 3-2021*
G. D. Manuel	*Agricultural Superintendent*	" " " " "	" "
H. J. Venning, Jr.	*Asst. Agricultural Superintendent*	" " " " "	" "
A. L. Knudsen	*Labor Superintendent*	" " " " "	" "
E. A. Schwing	*Entomologist (Part Time)*	" " " " "	" "
P. T. Rezner	*Field Superintendent*	" " " " "	" "
John Bryan	*Field Superintendent*	" " " " "	" "
J. P. Williams	*Civil Engineer*	" " " "	" "
A. H. Kaas	*Field Superintendent*	*Patterson, California*	*Patterson 186*
Dan Burr	*Field Superintendent*	*Walnut Grove, California*	*Walnut Grove 2646*
H. T. Carlson	*Asst. Agricultural Superintendent*	*Spreckels Sugar Company, Woodland*	*Woodland 1060*
J. C. Larsen	*Field Superintendent*	" " " "	" "
R. L. Merchant	*Field Superintendent*	" " " "	" "
M. G. Raney	*Field Superintendent*	" " " "	" "
C. W. Patrie	*Machinery Specialist*	" " " "	" "
R. D. Jones	*Livestock Specialist*	" " " "	" "

SOUTH SAN JOAQUIN DISTRICT

		Spreckels Sugar Company	
W. C. Waterman	*Agricultural Superintendent*	*462 Haberfelde Bldg., Bakersfield*	*Bakersfield 4-4904*
Conner A. Gobel	*Field Superintendent*	" " " "	" "

HONEY-DEW